MARINE REVIEW

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TRIALS OF TORPEDO BOAT DESTROYER LAWRENCE.

The torpedo boat destroyer Lawrence, built at the works of the Fore River Ship & Engine Co., Quincy, Mass., is one of the few boats of this class which has considerably exceeded the government requirements. The official standardization trial of the Lawrence was made over a measured mile off Provincetown in Massachusetts bay on Oct. 11 and was in charge of the official trial board, of which Capt. Charles J. Train is president. The Lawrence was compelled to use low-grade coal on account of the coal strike, but her eight recorded runs over the course showed the following results:

Run.		T.me.	Mean revolutions.	Rate of speed.
1	South	2.384	749.5	22.727
2	North	2.332	732.5	23.499
3	South	2.202	757.5	25.678
4	North	2.180	735.5	26.087
5	South	2,120	750.0	27.273
6	North	2.130	750.0	27.068
7	North	2.098	752.5	27.735
8	South	2.038	758.0	29.079

The boat was required to make double runs over the course, with and against the tide, at an average speed of 22 knots, 24 knots, 26 knots, and at her maximum, not less than 28 knots. After the Lawrence had made her sixth run, an auxiliary pipe in the after engine room burst, making it impossible for her to complete the best run of the day. The difficulty was soon remedied and the boat got a maximum record of 29.4, or more than a knot in excess of the government requirement, but her builders say that she would have done even better under more favorable conditions.

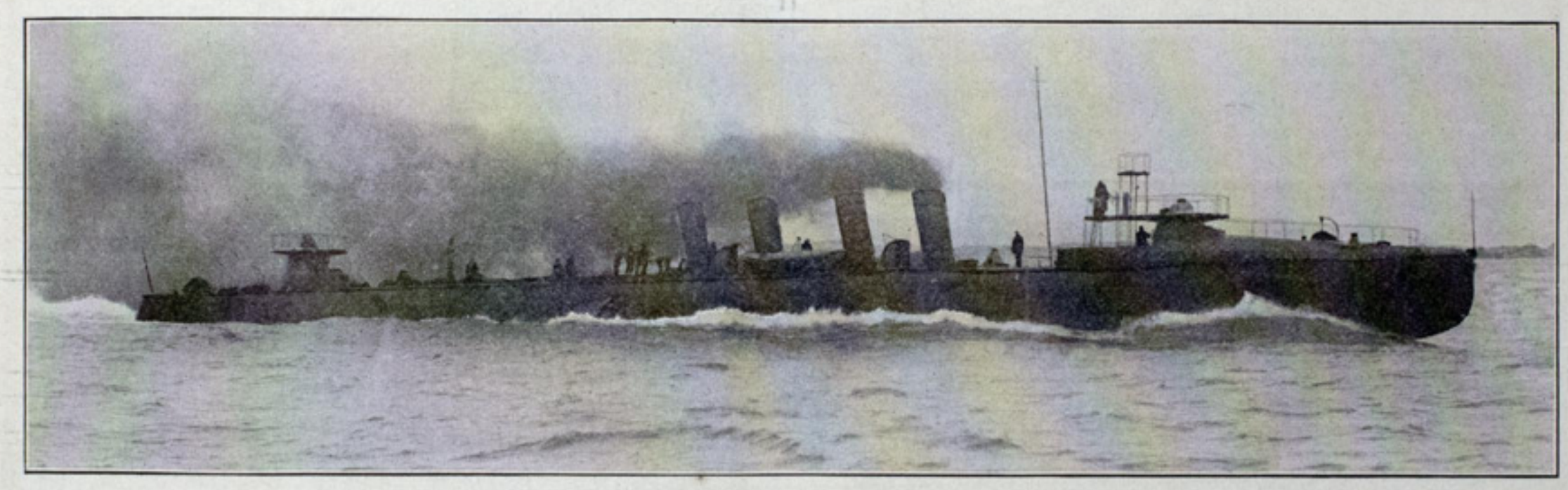
The Lawrence was given her official endurance trial of an hour's run to sea on Jan. 7 in a fresh southwesterly breeze and in this test she exceeded the government requirement, which was 26 knots. The steering and reversing tests proved entirely satisfactory.

The load waterline length of the Lawrence is 240 ft. 10 in.; length over all, 246 ft. 3 in.; extreme breadth, 22 ft. 3 in.; mean draught, 6 ft. 3 in.; depth from deck to keel, 14 ft.; displacement, 400 tons, and full-load displacement, 514 tons. Coal bunkers stand on either side for a length of 100 ft. amidships and have a capacity of 147 tons, which, it is calculated, will give the vessel a steaming radius of 3,000 miles at 14 knots or 1,000 at maximum speed.

The Lawrence has twin-screw, vertical, inverted, direct-acting, four-cylinder, triple-expansion engines. The high pressure cylinder is 22 in., the intermediate 31 in., and the two low-pressure cylinders 34 in. in diameter, and the stroke is 20 in. The main engines are in two separate compartments amidships, the starboard engine being placed forward of the port engine, and at 360 revolutions, with steam at 240 lbs., they are designed to develop 8,400 I. H. P.

The water-tube boilers were made by the Fore River company from its own designs, and they are placed, two in the forward and two in the after fire room, the fire rooms being forward of the engine rooms. The grate surface aggregates 315 sq. ft., and there are 17,768 sq. ft. of heating surface, with two blowing engines for forced draft in each fire room.

The destroyer is designed to carry two torpedo tubes for long 18-in. Whitehead torpedoes, mounted on the fore-and-aft line of the main deck. She will also carry two 3-in. rapid-fire and five 6-pounder rapid-fire rifles. The torpedo tubes are to be carried in watertight compartments just below the main deck.



U. S. Torpedo Boat Destroyer Lawrence making a record of 29.4 knots off Provincetown.

STEEL CORPORATION MEETING.

During the past week the presidents of the subsidiary companies of the United States Steel Corporation held a meeting in New York and discussed plans and policies. Very little could be learned regarding what was actually recommended but the following statement was published by the corporation:

"Various important questions have been fully discussed, carefully considered, and recommendations embodying the conclusions of the presidents will be submitted to the executive committee and finance committee, respectively, of the United States Steel Corporation, for consideration and recommendation. Among other subjects considered are proposed improvements and extensions to the manufacturing, mining and transportation properties of the various companies, and recommendations for the expenditure of considerable sums have been made. The improvements which will be made are in the direction of increasing production and facilities for manufacturing; but more especially to reduce the cost of production and distribution. There were also included in the discussions and recommendations the Union and Sharon steel properties, lately acquired, the management of which will be so divided and distributed as to give control of the same to other subsidiary companies interested in the same line of business. The question of transportation by outside railroad companies, particularly in the coal and coke districts, received much consideration, and recommendations were made which, if adopted, it is believed will be highly beneficial."

PROTECT THE AMERICAN SHIP YARD.

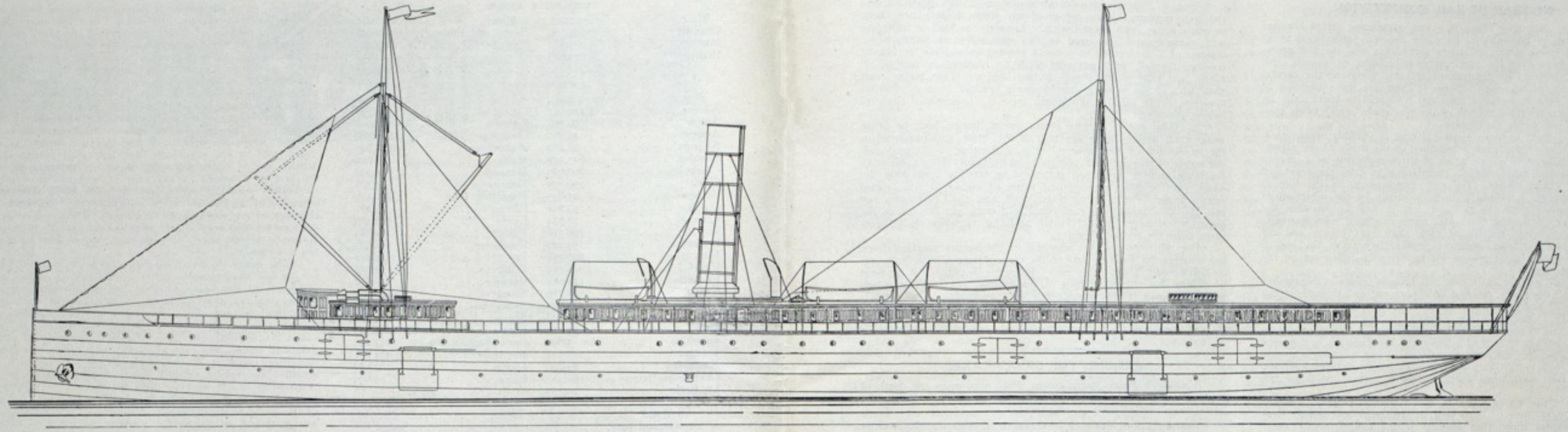
"I am of opinion that if something is not done by congress to aid our home industry in ship building there will be no American ship yard running in three years from today, and the great industry of ship building will be transferred to Europe," said Gen. C. H. Grosvenor, chairman of the merchant marine committee of the house of representatives in a letter dated Jan. 17, 1902, to Mr. Walter J. Ballard of Schenectady, N. Y. This is an example:

Exports, 1902	$1,355,481,861
Imports, 1902	969,270,009
Total	$2,324,751,870
Eight per cent. in American vessels	185,980,149
Freights lost on	$2,138,771,721

A loss of about $213,000,000 in money, to say nothing of the loss in prestige.

The fireboat which the New York Ship Building Co., Camden, N. J., is to build for the city of New York will be 117 ft. long over all, 110 ft. on the waterline, 24 ft. 3 in. beam and 9 ft. 3 in. draught.

The Nilson Yacht Building Co. will build a 110-ft. auxiliary schooner yacht for George C. Thomas, jr., of Philadelphia. She is to be 90 ft. on the waterline, 24 ft. beam and 6 ft. 6 in. draught.



Single Screw Passenger and Freight Steamer for the Ocean Steamship Co., Savannah, Ga.

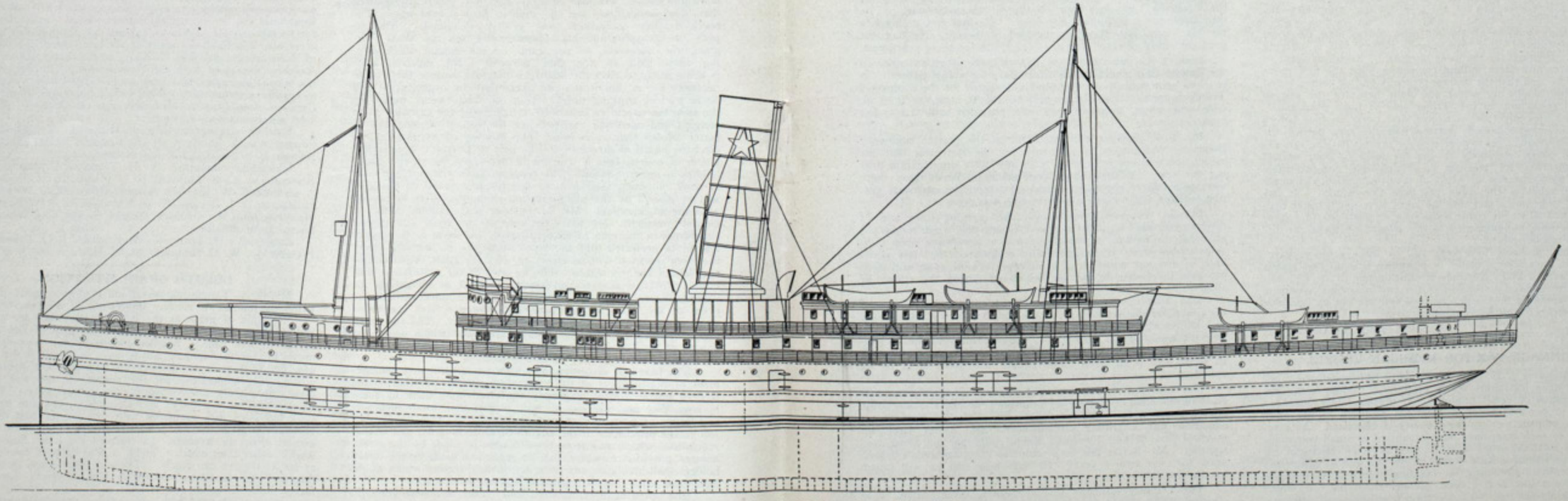
[*Building at Roach's Ship Yard, Chester, Pa.*

TWO FINE STEAMSHIPS

Roach's Ship Yard, Chester, Pa., is at present at work upon two excellent passenger steamers. The first is a single-screw vessel for the Ocean Steamship Co. of Savannah, of the following dimensions: Length over all, 396 ft.; beam, moulded, 49 ft.; depth to hurricane deck, 35 ft.; gross registered tonnage, 5,300. She will have a carrying capacity under beams of 375,000 cu. ft. and will carry on a given draught of water 3,500 gross tons of freight. She will have a speed of 13½ knots per hour. Her cabins are fitted for seventy-five first-class passengers and are to be finished in white and gold. The motive power will consist of a triple-expansion engine with cylinders of 28, 46, 75 in. diameter and 48 in. stroke, supplied with steam from four boilers, 15 ft. in diameter and 10 ft. 6 in. long. The steamer will be equipped throughout with up-to-date auxiliary machinery and will have facilities for handling freight with dispatch. In appearance and fittings she will resemble the City of Memphis of the same line, which was turned out at Roach's last May. She will in effect be a duplicate of the Memphis. The Memphis, with 500 tons more deadweight cargo capacity than the builder was required to furnish, has never fallen below her guaranteed speed, not even in the most severe and trying head gales known on the Atlantic coast, through which she has passed more than once. In a recent trial from Savannah the City of Memphis covered the distance between Savannah and New York, dock to dock, 720 nautical miles, in 52 hours and 30 minutes, averaging thereby a speed of 13.70 knots. She carries more cargo at greater speed and with less coal than was guaranteed and does it comfortably.

The second vessel is a twin-screw steamship for the New York & Texas Steamship Co. (Mallory Line) and is intended for service between New York and Galveston, Texas. She is of the following dimensions: Length over all, 400 ft.; beam, 53 ft.; depth, molded to hurricane deck, 35 ft.; gross registered tonnage, 5,500; cargo capacity under beams, 350,000 cu. ft. She is expected to carry 3,500 tons of cargo on a given draught of water. It is the expectation that she will cover the distance between New York and Galveston in about four and a half days. She will have accommodations for eighty first-class and forty-five second-class passengers. The first-class cabins will be fitted in hardwood and all the equipment will be in accordance with the latest design and finish. The propelling power consists of two direct-acting, triple-expansion engines, with piston valves actuated by the Marshall valve motion, having cylinders of 27½, 44½ and 70 in. diameter and stroke of 42 in. Steam will be supplied by three double-ended and two single-ended boilers, allowed a working pressure of 180 lbs. per square inch.

Hull model and equipment of both these steamers were designed by Mr. R. T. Dickinson, superintendent of the Roach yard; and the engines, boilers and general machinery by Mr. Thomas Mooney.



Twin Screw Steamship for the Mallory Line of New York.

[*Building at Roach's Ship Yard, Chester, Pa.*

Lake Superior Iron Ore Shipments (Gross Tons) for 1902 and the Past Forty-seven Years.

January 29, 1903.] Supplement to THE MARINE REVIEW, Cleveland. [Vol. XXVII, No. 5.

NAME OF MINE.	Prior to 1887.	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	TOTALS.
Marquette Range.																		
American (Sterl'g)	20,039	1,483	13,699	20,032	21,000	21,604	15,076											112,933
Barnum (B)	762,682	16,123	10,211	12,835														801,851
Bessie						847											5,007	5,854
Beaufort	77,388	12,829													1,583	4,338	59,781	155,919
Blue								13,809	32,171	44,140		2,519						92,639
Boston	61,955										587							62,542
Buffalo (A)	10,860	24,686	30,801	50,919	100,464													217,730
Braastad { Mitch'l	116,126	16,419	4,091															136,636
Braastad { Wint'p	515,248	74,067	86,789	155,341														831,445
Cambria	337,079	41,130	57,861	72,780	80,359	34,662	41,549	30,445	47,218	41,656	95,086	110,648	102,623	124,930	80,432	68,907	63,976	1,431,341
Champion	1,761,564	146,330	174,680	215,098	223,442	133,413	109,979	61,648	42,788	100,398	113,375	141,728	163,190	215,074	113,743	99,026	205,721	4,021,197
Chester	233,165	1,058	402									3,975			22,585	22,815	24,874	308,874
Cleve'd-Cliffs I. Co.	3,497,513	207,441	184,316	274,048	331,713	221,788	310,907	218,105	143,706	221,153	513,119	718,408	869,482	1011,048	881,021	860,484	1,104,864	11,569,116
Curry				16,671														16,671
Detroit	80,050	26,099	18,500	10,112	6,080													140,841
Dexter	21,830		1,821	3,895	9,136	5,448	13,000	7,833	21,740	13,752	18,903	1,154						118,512
East Champion	73,305			2,697														76,002
East New York			13,694	29,739	36,431	50,293	35,175	911							27,987	31,696	38,761	264,687
Fitch					16,550	15,093				174								31,817
Foster (B)	149,944				21,949													171,893
Gibson	13,657	2,700																16,357
G'd Rapids (Davis)		1,200	11,611	20,058	26,426	9,362	22,823	352	12,073	6,764	67							110,736
Hartford				566			5,678	6,513			1,532						7,440	21,729
Hortense (N. Ch'p'n)		886	5,685	7,757	16,246													30,574
Humboldt	626,561	19,873	11,655	15,866	23,259	19,879	4,571				2,297							723,961
Iron Cliffs (K)		87,346	78,520	134,616	188,776	278,270	289,395	130,812	253,760	259,042								1,700,537
Imperial					38,460	18,552	7,194							23,225	62,321			149,762
Jackson	2,604,545	109,906	101,909	128,891	124,682	92,979	92,567	51,009	32,298	42,186	80,710	79,102	55,012	88,230	31,714	38,271	15,449	3,769,463
Lake Angeline																	304,125	304,125
Lake Superior	3,892,222	302,909	240,225	288,784	318,321	308,831	366,715	329,610	344,758	342,439	459,576	376,761	686,563	682,595	709,143	635,642	832,796	11,117,890
Lillie	121,509	23,041	32,692	33,916	31,812	19,551	29,005	68,861	78,388	54,285	107,532	112,781	211,023	196,200	114,990	98,788	79,919	1,414,293
Lucy (McComber)	307,427	12,139	22,276	32,982	43,483	27,683	26,326	21,964				10,033	11,846					516,159
Manganese	6,359																	6,359
Marquette (C)	5,229	20,441	7,060	70,128	23,692	16,802	9,555											152,907
Mesabi's Friend										5,503	10,540							16,043
Michigamme (K)	616,590	58,726	36,448	56,999	80,777	23,169	1,894	935	1,610	3,214								880,362
Milwaukee	198,563	50,490	48,908	52,727	24,763													375,451
Moore															4,648	37,655		42,303
Negaunee		5,259	45,304	78,318	76,488	64,218	85,846	69,732	132,581	90,682	175,394	182,169	191,330	195,573	126,829	234,713	204,286	1,958,722
" Con. Wks.	12,708																	12,708
New York (York)	1,035,001	5,128		12,844	2,422		11,220	25,000	21,487					6,642	3,327			1,123,071
N. Y. Hematite	37,587																	37,587
Norwood		2,200	3,553															5,753
Nonpareil (St. Law.)	21,959	1,436																23,395
Pascoe	59,806																	59,806
Pendill	45,993																	45,993
Phenix (Dalliba)	57,509	1,605																59,114
Pioneer	5,104	1,203	9,066															15,409
Pitts. & L. Angel'e	896,986	191,120	223,600	229,670	261,681	241,605	287,517	351,973	355,453	313,555	342,251	489,685	460,333	464,988	389,128	481,574		5,990,519
Platt							2,676	5,448	41,226	13,198	11,296							73,844
Princeton (Sw'nz'y)	151,854	2,842				7,301	29,403	19,096		6,593			25,247	55,802	75,037	67,061	118,048	558,274
Queen			5,527	66,122	141,632	479,509	379,719	106,864	220,298	160,817	323,057	239,774	61,022	342,978	398,298	400,845	418,044	3,531,225
Republic	2,584,826	220,624	235,062	287,390	220,065	191,127	167,991	64,195	105,719	174,027	147,360	124,342	140,312	137,085	130,126	104,604	157,646	5,172,501
Repub. Reduc. Co.		87	21,050	22,122	3,915													47,174
Richmond											1,088	4,630	24,464	4,613	51,303	54,181	50,041	190,320
Riverside			5,622	3,712		6,783		43										16,160
Saginaw	447,104					4,320												451,424
Salisbury (B)	404,913	48,304	74,947	72,449	85,798													686,411
Sam Mitchell	8,823	8,411	546															17,780
Samson (Argyle)	258,679		4,512	2,796	1,218		600											267,806
South Buffalo (A)		4,964	24,706	69,359	146,383													245,412
Spurr	164,244																	164,244
Star West (Wheat)	64,514	17,538	4,987	7,997	15,141	4,412			5,550	51,207	9,658	942		6,716	15,987			204,649
Taylor	32,970																	32,970
Titan	71,522	16,003	2,846															90,371
Volunteer	365,460	47,486	56,321	60,156	141,524	92,699	127,130	69,561	26,946	32,672	53,216	1,617		29,983	47,578		32,736	1,185,085
Webster	11,606	2,054		448											20,797			34,906
West Republic	108,834	12,872	9,861	1,510														133,077
Wetmore	25,782	3,335	2,074	19,679														50,870
Winthrop					109,576	122,042	191,658	180,071	134,365	119,120	150,496	106,894	122,592	171,318	148,945	109	129,496	1,570,135
Miscellaneous	*a* 364,736	*b* 1,841	*c* 289	*d* 1,384				*e* 2,790	*f* 5,195	*g* 1,261	*h* 7,081	*i* 7,873						392,450
Total	23,349,969	1851,634	1923,727	2642,813	2993,664	2512,242	2666,856	1835,893	2059,330	2097,838	2604,221	2715,035	3125,039	3757,010	3,457,522	3240,699	3,853,010	66,686,502
Mesabi Range.																		
Adams										59,141	234,562	170,738	390,860	720,474	777,346	829,118	1,242,923	4,425,162
Aetna (Lowmore)								1,645			17,723						196,316	215,684
Agnew																	45,582	45,582
Auburn									108,210	376,970	131,478	175,263	235,630	385,992	263,692	427,510	38,283	2,143,028
Biwabik								151,500	90,048	247,069	242,568	427,464	383,180	553,836	924,868	410,074	623,127	4,053,731
Canton								24,416	213,853	359,020	16,261			99,498				713,048
Chisholm																34,573	200,629	235,202
Cincinnati								26,372		17,187	57,324	32,912		246				134,041
Clark															63,071	199,566	350,799	613,436
Cloquet (Vega)									5,628	47,700	96,280	12,215		1,621				163,444
Columbia																15,627		15,627
Commodore								65,137	7,213		22,063	60,798	80,494	152,947	278,416	35,546	65,833	768,447
Corsica																26,838	59,292	86,130
Croxton																	18,594	18,594
Day													18,651	1,975			106,516	127,142
Duluth								37,626					112,155	165,435	128,587	150,024	150,220	744,047
Elba													564	9,547	121,707	224,630	207,454	563,902
Fayal										136,601	248,645	642,939	575,933	1072,257	1,252,504	1656,973	1,919,172	6,405,024
Franklin								46,617	223,399	286,423	231,086	30,128	200,400	60,000	168,524	39,299	111,085	1,396,961
Genoa											17,136	309,514	279,677	276,559	253,651	332,022	399,719	1,868,278
Glen																	23,875	23,875
Grant																	51,946	51,946
Hale								3,616	24,167	31,004	70,006	13,728		18,807	32,901	30,929	54,289	279,447
Hawkins																	5,892	5,891
Jordan																	147,931	147,931
Kanawha														14,963	64,218	41,300	24,829	145,310
Lake Sup. Group										58,123	67,659	259,912	135,404	154,326	284,023	594,761	766,311	2,330,519
La Belle																	70,753	70,753
Laura																	16,453	16,453
Leetonia																	28,784	28,784
Lincoln																	87,908	87,908
Longyear																	22,788	22,788
Mahoning										117,884	167,245	519,892	520,751	750,341	911,021	765,872	1,038,645	4,791,651
Malta														28,615	65,346	126,299	222,640	442,900
Minorca																	35,499	35,499
Minnewas								13,858	2,140									15,998
Morrow																	35,571	35,571
Mtn. Iron (& Rath.)							4,245	119,818	573,440	371,274	142,021	773,538	650,965	1137,970	1,001,324	1058,160	1,421,456	7,254,201
Norman									38,969	93,392	77,523	101,077	110,141					421,132
Ohio										28,943	69,925	47,350	101,607	293,651	172,597			714,073
Oliver (I)								123,015	505,955	500,377	808,291	601,072	349,100		244,876	5,420	5,131	3,143,237
Pearce																	54,884	54,884
Penobscot												11,933	29,652	85,619	146,641	221,080	209,531	704,456
Pettit																	17,278	17,278
Pillsbury													99,691	106,487	101,032	120,723	238,122	666,055
Roberts												18,614		57,847	41,965	42,766	28,972	190,154
Sauntry														53,004	68,560	328,739	249,837	700,140
Sellers										47,433	153,037		112,765	174,867	56,280	34,918	193,428	772,728
Sharon																56,810	224,526	281,336
Sparta												66,722	226,156	237,143	202,144	156,426	227,444	1,116,035
Spruce															101,675	279,515	543,203	924,393
Stevenson															56,031	666,273	1,434,681	2,156,985
Union															8,297	93,109	103,522	204,928
Utica																	9,009	9,009
Wills																	12,158	12,158
Williams (N. Cin'ti)										3,046	11,249			12,357	18,238			44,890
Total							4,245	613,620	1793,052	2781,587	2882,079	4275,809	4613,766	6626,384	7,809,535	9004,890	13,342,840	53,747,807
Miscellaneous	2,320																	2,320
Menominee Range.																		
Antoine										27,931	110,821	98,847	104,510	93,025	119,940	63,429	110,993	729,496
Appleton							4,377	5,618		2,107								12,102
Aragon				1,745	46,609	96,829	167,948	127,901	138,209	183,296	95,809	149,504	295,821	337,807	404,645	477,212	646,203	3,109,628
Armenia				50,275	26,649					2,045						18,750	100,864	198,613
Baltic																17,326	64,664	81,990
Beta	1,585	1,226				1,400												4,211
Breen	17,430																	17,430
Brier Hill	14,981																	14,981
Bristol (G)							57,352	9,612						80,915	51,639	36,593	129,035	365,136
Calumet	38,713																	38,713
Chapin	1,329,711	336,128	290,871	518,990	742,843	488,749	660,052	489,134	235,895	618,589	420,318	643,402	724,768	940,513	929,937	929,701	956,812	11,256,413
Columbia	41,338	2,377	10,936	11,385	60,133	70,770	57,682	22,426	10,300	70,967	87,202	24,623	14,199	126,290	97,531	19,963	186,798	914,820
Commonwealth	373,166	56,609	61,818	108,515	116,786	134,982	249,113	151,291	174,921	208,880	93,707	98,283	250,687	117,295	53,342	77,799	112,704	2,439,898
Cornell	47,238	2,064																49,302
Crystal Falls	1,341				3,974					13,037	44,526	96,210	128,233	147,346	197,770	230,614	195,555	1,057,606
Cuff														20,210	38,209			58,419
Candy											3,395	41,942	76,877	100,902	141,148	178,800	183,052	726,116
Curry (F)	84,214		5,376	28,722	72,162	100,681	125,773											416,928
Cyclops (F)	231,345	14,297	14,693	6,101	7,361	10,599	1,697											286,093
Delphic	31,446	2,272									52							33,770
Dober (H)													5,009	10,980	49,203			65,192
Dunn		24,677	118,096	151,828	156,963	162,721	133,666	58,590	24,538	90,885	47,081	31,062	49,381	7,458			2,816	1,059,762
Emmett	66,655																	66,655
Ethel (Hennepin)																	14,455	14,455
Fairbank	8,500																	8,500
Florence	323,241	79,399	142,585	196,269	218,570	48,806	48,246	9,634	2,726	22,820	35,136	37,594	93,663	74,235	35,756	15,395	130,798	1,514,873
Foxdale																4,647	15,015	19,662
Great Western	66,389	23,239	21,860	38,454	72,546	62,464	87,487	661			14,643		33,851	43,316	98,550	123,261	42,470	729,191
Groveland						1,049										11,444	7,599	20,092
Half and Half				5,961	1,496	67												7,524
Hamilton	872	600	8,801	8,347	17,072	58,197	2,183											96,072
Hemlock						35,531	65,459	11,323		949	94,645	96,032	69,865	110,269	72,413	149,966	123,331	829,783
Hersel					955													955
Hiawatha								1,683		1,201					11,008	20,355	74,596	108,843
Hilltop														3,496	6,410	2,503		12,409
Hollister					2,020	1,057	1,021											4,098
Hope							15,543	2,275									3,373	21,191
Indiana	17,871																	17,871
Iron River (H)	316,352	83,018	110,000	179,238	155,458	59,345	1,176											904,587
Keel Ridge	59,465						5,997	3,298		19,441				4,900				93,101
Lamont (Monitor)				12,348	31,139	26,226	42,819	13,777	2,600					67,652	31,323		47,267	275,151
Lee Peck (D)							2,844											2,844
Lincoln						1,813	26,019	8,757						43,622	72,959	19,727	7,747	180,644
Loretto								8,131	55,983	53,160	34,334	54,104	68,447	64,824	61,219	54,985	128,300	583,487
Ludington	466,787	101,653	61,883	116,297	97,355	141,303	15,777	109	354									1,001,518
Manganate					6,844													6,844
Mansfield					18,303	49,836	69,259	69,558				37,182	60,739	86,607	90,155	74,113	31,181	586,933
Mastodon	93,618	48,792	51,463	63,511	66,526	45,370	9,150	23,485		23,733	60							425,708
Metropolitan	94,467	9,070	3,490															107,027
Michigan Explo. Co.								505	77	1,071		216					53,272	55,141
Millie (Hewitt)	39,439	1,163	11,124	12,274	39,232	5,889	6,780		13,062	10,924	21,815	10,374	17,439	15,194	14,922	12,133	25,935	257,690
Monongahela																2,397		2,397
Nansimo	74,721	30,460	5,744		3,441	13,200												127,566
Northwestern	17,206																1,324	18,530
Norway (F)	929,749	95,726	87,260	68,044	61,717	4,089	44,767											1,291,352
Paint River	40,446	10,240	12,506	32,700	62,654	45,435	18,390								1,316		10,383	234,070
Penn Iron M'ng Co.								280,450	175,274	290,622	179,917	237,886	223,713	229,651	197,606	358,126	273,443	2,446,688
Perkins	342,221	10,834	16,684	12,354	11,971					2,161								397,225
Perry	3,138																	3,138
Pewabic					26,991	64,507	115,273	165,745	304,010	262,551	272,587	279,855	305,072	530,129	374,043	507,786	530,291	3,739,840
Quinnesec	274,489	6,585	2,249							761				11,050	25,967	66,383	62,531	450,015
Riverton														2,202	71,004	119,860	215,850	408,976
Selden	790	1,302																2,092
Sheridan				1,102	595	7,137	45,745	2,234		16,754	3,419	146		31,104	8,063			116,299
South Mastodon			2,722	4,005	1,476													8,203
Stephenson	35,761	3,589																39,350
Sturgeon River		6,829	7,800	4,775														18,404
Tobin																18,967	55,228	74,195
Verona															5,143	11,475	43,245	59,863
Vivian																	40,384	40,384
Vulcan (F)	816,300	205,036	129,541	153,900	104,996	78,967	179,904											1,668,654
Walpole		1,740	900	9,614	2,940	3,895												19,089
Youngstown	55,469	34,418	12,699		44,460	3,705				13		661						151,425
Total	6,556,464	1193,343	1191,101	1796,754	2282,237	1824,619	2261,499	1466,197	1137,949	1,923,798	1,560,467	1,937,013	2,522,265	3,301,052	3,261,221	3,623,730	4,627,524	42,267,233
Vermillion Range.																		
Chandler			454,612	306,220	336,002	373,969	651,655	435,930	558,050	605,024	471,545	438,365	715,919	808,350	644,801	627,379	645,786	7,673,616
Minnesota	592,004	394,252	57,341	535,318	532,000	517,570	498,353	370,303	390,463	432,760	448,707	592,196	426,040	457,732	325,020	208,284	275,168	7,453,511
Pioneer				3,144	12,012	3,079	2,651			40,054	149,073	207,103	123,183	339,897	450,794	678,310	673,863	2,683,163
Savoy (and Sibley)														86,191	175,116	212,008	322,241	795,556
Zenith							14,991	14,388			18,765	40,817		79,323	60,089	60,082	167,205	455,660
Total	592,004	394,252	511,953	844,682	880,014	894,618	1167,650	820,621	948,513	1,077,838	1,088,090	1,278,481	1,265,142	1,771,502	1,655,820	1,786,063	2,084,263	19,061,506
Gogebic Range.																		
Ada														7,977	25,047		8,555	41,579
Anvil		10,075	24,676	47,000	45,690	73	42,090		13,297	68,064	57,483		5,037			1,101	135,502	450,088
Ashland	80,756	175,563	174,183	257,915	435,949	267,439	231,896	66,067	83,020	126,096	91,149	111,625	123,208	154,615	232,961	286,399	301,824	3,200,665
Atlantic		1,369								70,989	60,727	50,207	38,058	19,964	135,955	190,135	190,213	757,717
Aurora	99,975	159,252	179,937	199,865	246,696	83,554	319,482	179,028	203,152	245,883	187,169	166,122	133,076	170,369	193,111	223,747	402,981	3,393,398
Bessemer	4,788	16,101																20,889
Blue Jacket		1,799																1,799
Brotherton	8,880	21,721	40,639	53,267	80,486	46,574	139,833	18,905	47,148	40,567	50,490	46,186	73,198	78,858	89,804	103,109	53,255	983,920
Cary (and Superior)				56,842	116,203	121,186	106,484	28,578	16,559	52,349	38,821	37,308	43,162	62,524	125,496	179,374	136,895	1,121,481
Chicago											504				633		44,625	42,762
Colby (E)	342,756	258,518	285,880	136,833	193,038	9,619	69,968	59,346	32,616		48,492	22,921	152,875	103,239	32,572	23,475	22,526	1,794,674
Eureka					23,794	13,907	10,655	31,385	18,329	26,105	4,544							128,719
Federal					21,150	6,778												27,928
Harm'ny (G'rm'nia)	25,202	61,714	53,918	103,169	52,000	22,383	4,283	7,964				1,015			986	10,358	20,502	363,494
Hennepin			28,721	76,545	63,903	15,759									7,728	21,475	36,383	250,514
Imperial							8,515											8,515
Iron Belt			30,000	51,551	110,368	1,506	161,635	23,976	45,109	148,228	81,351	96,763	58,418	105,934	54,664	43,883	79,121	1,092,507
Iron Chief	9,950	2,249																12,199
Ironton	18,424	24,762		8,635	6,247	300											8,555	66,923
Jack Pot							3,944	1,651				1,265			33,893	19,988	102	61,843
Kakagon	18,497	52,179	1,228															71,904
Meteor (Comet)					2,882	10,144	54,779	9,604	11,782					332	7,844	34,140	19,117	150,624
Mikado										4,788		11,897		10,324	1,090	91,846	98,834	218,279
Minnewawa														1,255				1,255
Montreal	23,013	43,989	38,015	42,724	16,728	70,108	58,728	34,299	46,037	138,882	131,531	191,106	270,776	153,307	107,524	72,945	136,354	1,576,066
New Davis					1,497		21,754	15,210		10,253				5,029	3,569		31,530	88,842
Newport	20,184	75,660	69,145	36,987	71,488	105,606	165,962	109,718	150,392	157,821	142,369	150,979	196,953	263,711	217,201	190,448	141,571	2,266,195
Nimikon	4,105	23,217	1,313															28,635
Norrie	140,263	237,254	412,196	674,394	906,728	758,572	985,216	472,062	621,608	738,480	329,068	604,281	709,590	714,669	666,389	660,965	1,080,032	10,703,167
Odanah	13,714	30,475	5,412	13,354	1,065		6,711	3,956	2,437									77,124
Ottawa																	26,141	26,141
Pabst (J)	19,082	19,906	49,976	116,276	172,069	130,226	113,245	104,510	206,074	219,960	68,984	220,496	223,891	263,869	239,242	198,686		2,366,583
Palms		1,414	9,725	35,245	50,604	32,227	102,382	2,658	37,911	46,965	114,108	207,153	175,925	154,705	139,658	7,603	32,113	1,150,396
Pence			26,687	574							13,185	120						40,566
Pike															3,434	6,346	6,343	16,123
Puritan (Ruby)	16,388	45,000	3,058	9,472	11,694	913										21,788		108,313
Section 33				73,370	126,963	38,576	14,681											253,590
Shores											12,196	16,102	15,691	11,819				55,808
Sparta							2,912			1,950								4,862
Sunday Lake	12,368	18,137			6,010	64,902	56,046	22,876	34,323	20,970	89,441	45,815		12,526	74,097	89,997	144,630	692,138
Superior	2,690	27,763			36,675	10,710	13,192		30,597									121,627
Tilden						28,415	233,356	135,118	209,077	418,188	250,205	276,890	287,203	500,830	481,909	446,670	468,672	3,736,533
Trimble	10,780	12,764	2,387															25,931
Tyler's Forks					10,683													10,683
Upson																	11,065	11,065
Windsor				14,576	37,210	97	53,242	2,474		11,438	28,154	385			488	841		148,905
Yale (West Colby)																12,836	26,043	38,879
Miscellaneous	*j* 4,429	*k* 1,997																6,426
Total	874,244	1322,878	1437,096	2008,394	2847,810	1839,574	2971,991	1329,385	1809,468	2,547,976	1,799,971	2,258,236	2,498,461	2,795,856	2,875,295	2,938,155	3,653,484	37,818,274
GRAND TOTAL	31,175,001	4762,107	5063,877	7292,643	9003,725	7071,053	9072,241	6065,716	7748,312	10,429,037	9,934,828	12,464,574	14,024,673	18,251,804	19,059,393	20 593 537	27,571,121	219583,642

A—Now Queen. B—Now Iron Cliffs. K—Under Clev'd-Cliffs I. Co. after '95. I—Mesabi Mtn. and Lone Jack. C—1893 and later in Winthrop. D—Cherry Valley Ore. E—Includes Tilden up to 1891. F—1893 and later under Penn Iron Mining Co. G—Formerly Claire. H—Now Riverton. J—Under Norrie after 1901.

a Bay State 16,637, Chicago 9,012, Columbia (Klomin) 94,813, Dey 2,709, Erie 8,136, Etna 1,091, Goodrich 49,754, National 150,216, Section 12, 21,887, Wheeling 10,486. *b* Iron Mountain 393, Richards 1,374, Wheeling 74. *c* N. Republic 289. *d* Edison 893, Quartz 491. *e* Ames 1,103, Northwest 1,687. *f* Ames 5,195. *g* Schadt 1,261. *h* Palmer 1,041, Primrose 6,040. *i* Ogden 986, Richards 6,887. *j* Iron Chief No. 2, 551, Valley 1878. *k* First National 1,997.

WORK AT FORE RIVER.

The Fore River Ship & Engine Co., Quincy, Mass., has just laid the keel of the six-masted steel schooner to be named the William L. Douglas, after one of her shareholders, and to be built by a syndicate headed by Capt. John G. Crowley, the managing owner of the Lawson. The Douglas, like the Lawson, is to be a collier and is planned to have a very large capacity and an equipment for most economical management. She will have engines to handle her sails and load and discharge her cargo, steam steering gear, and all of the mechanical appliances by means of which Capt. Crowley believes the American schooner will be enabled to re-establish the American merchant marine as ocean freight carriers. She will measure 339 ft. 6 in. over all, and 306 ft. on the waterline, with 48 ft. beam and 29 ft. 9 in. depth. This gives her a hold capacity of 5,700 tons of coal—half as much again as that of the largest six-master now afloat. Her masthead will be 120 ft. above the deck, the top masts being Oregon pine spars fitted into cylindrical steel lower masts; from these will be stretched upwards of 36,000 sq. ft. of duck. She will have two decks, with a tank for water ballast reaching from the keel to the second deck.

The preliminary work of making final detail plans for two new steamers to be added to the Fall River Lines Long Island sound service is now under way at Fore River. The construction of these two boats will, in some ways, be of especial interest, for they are the first sound steamers to be built in New England and are the first boats to be entirely built for this particular line at one plant, the custom in the past having been to construct the Fall River steamers under separate contracts for engines, hull and joiner work. A $1,000,000 passenger boat with accommodations for 1,200 people, and a $500,000 freighter are called for, both to be superior to anything built heretofore for the sound service. The passenger steamer will be a side-wheeler with twin engines, 297 ft. long over all, with 90 ft. of breadth across the wheel guards at the widest point, the steel hull having 50 ft. of beam and 21 ft. of depth, and the paddle boxes being built into the superstructure. She will have a double bottom divided into thirteen watertight compartments, and above that watertight bulkheads will separate the vessel into seven compartments, with a collision bulkhead and a watertight collision steel deck extending back from the stem about one-third of the steamer's length, 11 ft. below the main deck. The engines and the six Scotch boilers are to be in steel enclosures with walls that rise above the upper deck, and a steel deck will cover them. Steam steering gear will be used, and the auxiliary machinery includes an electric lighting plant capable of supplying current for 1,600 incandescent lamps. The fire extinguishing service called for by the specifications is particularly elaborate, the main pipes, under the immediate control of the engine room, with connections in every part of the vessel, being supplemented by separate powerful fire pumps in addition to the usual equipment of chemical extinguishers. Besides the customary lifeboats and rafts the steamer will carry a Lyle gun for shooting life lines. The interior finish is to be of pine, elaborately decorated with carving, frescoes and gilt work. A pressure water system supplied by a special pump, will be connected with all the plumbing.

The freight boat will be equally modern in construction and general equipment. She is to be a twin-screw steamer, with two 4,500-H. P. engines, and will be 318 ft. long over all, with a molded width of 60 ft. 6 in., and a molded depth of 26 ft. 6 in. She will have steam steering gear and there will be doubel freight elevators at her forward and aft hatches. All of the work on both vessels, except the furnishing and upholstery, will be done at Fore River.

Besides its ship building the Fore River company has in its forge and machine shops a large amount of heavy work, including the making of seventy sets of rapid-fire naval ordnance for the United States government—ten sets of 6-in., 50-caliber guns, which are the most approved pattern, for the main batteries of battleships and cruisers, and sixty sets of 3-in. pieces of like caliber, such as are used in the secondary batteries of larger vessels. These are the largest pieces of modern ordnance ever made in New England. They are forged, oil-tempered, annealed, bored and turned at Fore River and then sent to the shops at the Washington navy yard where all the naval ordnance is finished.

AN INTERESTING ADMIRALTY DECISION.

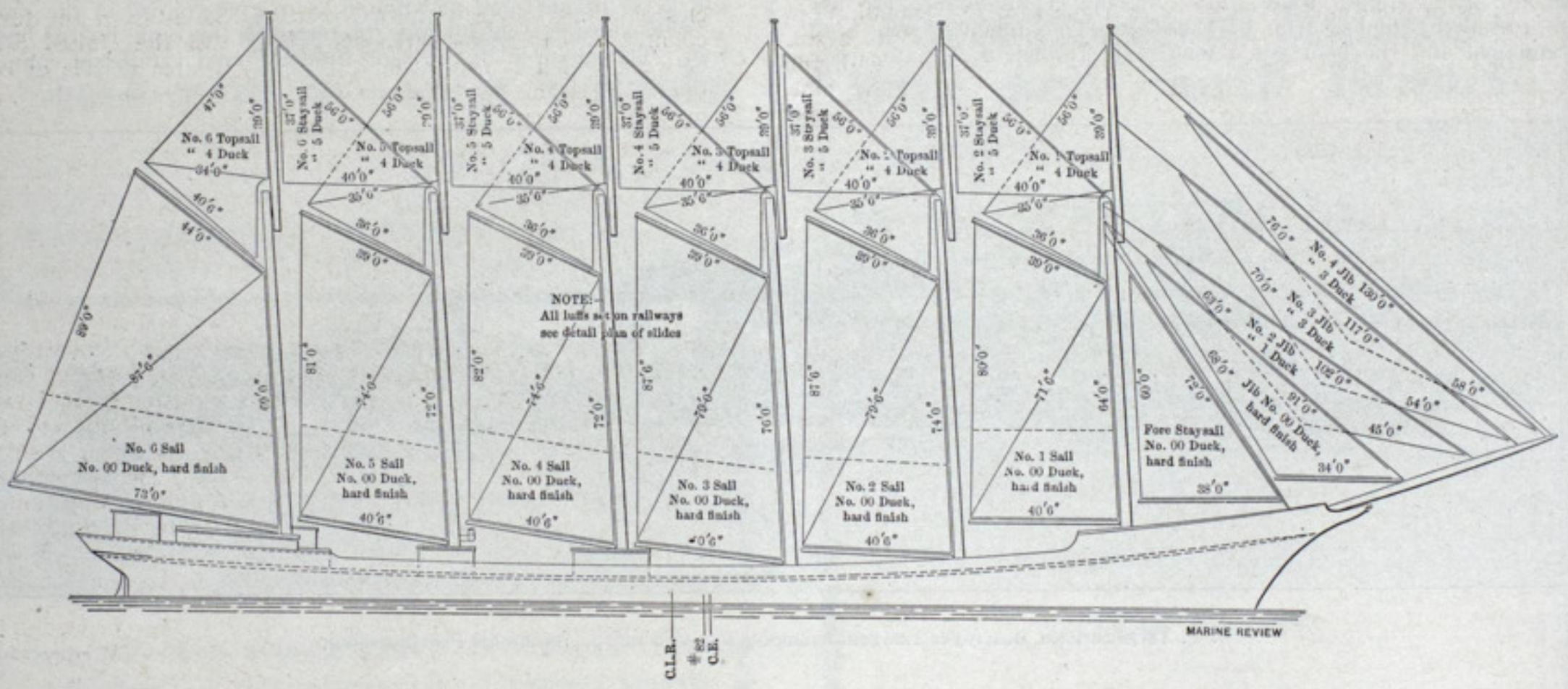
An interesting decision was handed down this week by United States District Judge Edward B. Thomas in Brooklyn in the case of Martin J. Garvey who had libeled a ship because of injuries sustained in falling through a hatch of the vessel while she was in dry dock for repairs.

Judge Thomas dismissed the libel, for the reason, he holds, that the admiralty court has no jurisdiction. This decision is noteworthy, and establishes a point that has never before been presented to the courts for settlement. It is held by Judge Thomas that being on dry dock the steamship was not on navigable waters, nor was the dry dock, which rested upon the water, and not the water's bed, a vessel in any sense, but was a part of the land itself. The decision says:

"The dry dock, consisting of five sections, connected by stringers, was fitted into piers, to which it was held by cleats, so that it had only a vertical motion. If the cleats were removed the dry dock would be drawn out of position and would float. This action is based upon an alleged maritime lien upon the ship. The action must be sustained, if at all, upon the theory that the dry dock was a vessel in navigable waters, or that the ship was in navigable waters. The first alternative is negatived by the case of Cope vs. Vallette Dry Dock Co. Thus the final question is, was the ship in navigable waters? In her position on the dry dock she was not only out of commission and withdrawn from navigation, but was also incapable of navigation.

"The ship could not be navigated on the dry dock, nor could the combined ship and dry dock be navigated in the water. Hence, if the ship be eliminated from consideration, the injury on the dry dock was not on a vessel in navigable waters; or, if the ship be considered, she was not on navigable waters or capable of navigation; or if the combined ship and dry dock be considered, the whole was not a ship or capable of navigation.

"The piers pertain to land, and the dry dock is adjusted to and intended to be an attachment to the piers. The fact of its resting in the water rather than in the water's bed and rose and fell with the tide, did not make it a vessel, nor a part of the water. Its nature pertained not to water, but to land. To land it was attached, and to land it was intended to be a part. The pertinent decisions have been so often discussed by this and other courts that there is no occasion for reconsidering them. This precise question is thought not to have arisen before, but the solution depends upon very obvious and fundamental rules relating to the admiralty jurisdiction. The libel is dismissed solely for the want of jurisdiction."



Sail Plan of the Six-masted Steel Schooner William L. Douglas.

A. C. Brown & Sons, Tottenville, S. I., have secured an order for a new tugboat from O'Brien Bros., New York. She will have a wooden hull and will be 74 ft. long, 19 ft. 6 in. beam and 8 ft. 6 in. deep.

SHIP BUILDING NOTES FROM NEW YORK.

New York, Jan. 28.—The United States Ship Building Co. has been awarded contract for building two steel, double-deck, propellor ferry boats for the Erie Railroad Co. The Burlee Dry Dock Co., Port Richmond, Staten Island, secures a contract for one ferry boat, a duplicate of the others. The vessels will each be 224 ft. long, 64 ft. beam over guards, 17 ft. 9 in. depth and capable of seating 900 passengers. The motive power will consist of double-compound engines, 18 and 38 in. cylinder diameters by 28 in. stroke, with two Scotch boilers, 12 ft. 9 in. by 12 ft. 9 in., and built for 150 lbs. steam pressure. These ferries are to be of the latest design and of staunchest construction, with steel bulkheads to upper cabin, oak finish, etc. The equipment will include Sturtevant ventilating and hot air system, duplicate electric light plants and other modern appliances that will make the vessels equal to anything of their kind now in use. They will be larger and it is intended that they shall be finer and better than the large double-deck ferry boats now in use by the Pennsylvania company. They are to be used between the Erie terminals on Jersey shore and New York city. It is understood that their cost will be $230,000 each. J. W. Millard, 32 Broadway, New York, is the designer of the boats.

Among pleasure craft under way at the works of the Marine Construction & Dry Dock Co., Mariner's Harbor (Staten Island), New York, is a wooden steam yacht, designed by J. W. Millard, naval architect and marine engineer, and being built for F. E. Underwood, president of the Erie railroad. This yacht is to be 96 ft. on the water line, 116 ft. over all, 17 ft. beam and 9 ft. 2 in. depth. She is to have owner's quarters forward and crew's quarters aft. Her interior fittings will be of mahogany and no expense will be spared in making her of the very highest class. She is to be fitted with triple-expansion engine, and although there has been no definite speed guaranteed, it is expected that she will be a very fast vessel.

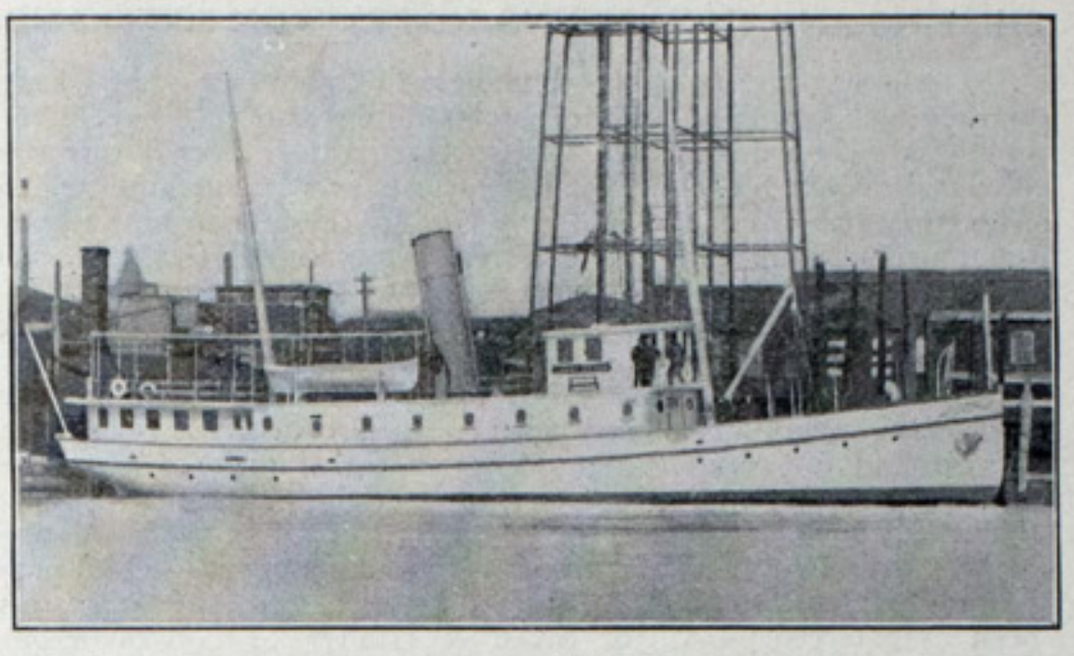
A schooner-rigged gasoline launch, building for Mr. H. R. Stearns of the Hotel Navarre, New York, is 62 ft. over all, 50 ft. water line, 4 ft. 6 in. deep, 3 ft. draught and 11 ft. 6 in. beam. She has a clipper bow and raised pilot house forward, with full cabin, and overhang stern. The planking is of yellow pine, copper fastened. Her cabin, pilot house, engine room, toilet and passage ways are to be mahogany throughout. The pilot house forward is to be well supplied with lockers, chart drawers, etc., and with sliding door for entry to the deck. The main saloon will be furnished with Pullman type of folding berths, the same to have mahogany panels exposed when closed. A stationary mahogany table will be in the center of the room. The ceiling is to be panelled and to be finished most artistically in green enamel with gilded moulding. Upright mirrors on port and starboard sides in the after part of the cabin are to be made of heavy plate glass. The companionway steps leading from the saloon to the after deck are to be made of mahogany.

A cabin gasoline launch, designed by Messrs. Colven & Bickmann of New York, is also being constructed at these works. She is 61 ft. over all, 55 ft. water line, 9 ft. 6 in. beam and 3 ft. 3 in. draught. Messrs. Colven & Bickmann have not made a specialty of this kind of work, but their general experience has certainly enabled them to produce in this little vessel one of the prettiest crafts of her kind to be found about New York and she will be very fast. A feature of the design is the combination of torpedo boat and overhanging yacht stern. Thus advantage is taken of the torpedo boat lines and at the same time the yachty appearance is maintained with more room on deck. The torpedo stern will extend about 4 ft. below the water line, in order that there may be no action of the waves against the flat surface, thus avoiding the thumping of waves which is a very disagreeable feature of such vessels. The interior finish will be in mahogany.

Still another vessel of the same yard is a 36-ft. launch designed by R. N. Haddock of Ossining, N. Y., for Mr. F. G. Mead. Her dimensions are 36 ft. 6 in. over all, 32 ft. water line, 8 ft. 3 in. beam. She is to be built of cedar on an oak frame, with outside trimmings of quartered oak. Cabin and pilot house are to be finished in mahogany. She will be one of the best of the type of launch which is getting to be very popular around New York and Long Island sound waters. These boats accommodate three or four people comfortably on a three or four days' cruise. Their draught, which is not excessive, makes it very convenient to enter all, or most of, the small and picturesque harbors abounding along the sound. The power is derived from a 12-H. P. Howard four-cycle motor and is sufficient to drive the boat at about 10 miles an hour, a very comfortable cruising speed.

STEEL STEAMERS FOR HARBOR SERVICE.

The Pusey & Jones Co., Wilmington, Del., has just completed for the quartermaster's department of the army two duplicate steamers for harbor service. They were christened respectively Henry Wilson and Sprigg Carroll. They are constructed of steel and are of the following dimensions: Length on deck, 110 ft.; length on load line, 104 ft.; beam, moulded, 24 ft.; depth amidship, 11 ft. 1 in.; draught loaded, 8 ft. 9 in.; speed per hour, 12½ miles. The machinery consists of a vertical, inverted, direct-acting, compound, surface-condensing



engine with cylinders 18 and 36 in. in diameter and stroke of 22 in., supplied with steam from a horizontal Scotch boiler, 10 ft. 6 in. in diameter and 11 ft. 6 in. long, allowed a working pressure of 150 lbs. per square inch. The steamers are completely equipped as standard steel steamers of the first class, including, of course, steam steering gear and electric light plant. The Wilson is now doing duty in New York harbor and the Carroll will sail from Wilmington within the next few days.

FITZGERALD'S SHIPPING BILL.

"Representative Fitzgerald of New York has introduced a bill in congress "to encourage and promote and develop the merchant marine of the United states." Mr. Fitzgerald's bill is as follows:

"There shall be allowed a rebate of 10 per centum of the duty imposed by law upon all goods, wares, merchandise, articles or things imported into the United States from any foreign country, or from any territory, property of the United States, between which territory and the United States vessels of other than American registry are permitted to engage in the carrying trade, whenever such goods, wares, merchandise, articles or things are carried in vessels of American registry."

The secretary of the treasury is directetd to make all necessary regulations for the proper enforcement of this act. Mr. Fitzgerald explains his bill as follows:

"This bill proposes a simple way to upbuild the merchant marine. It avoids all subsidies, and at the same time gives American ships tremendous advantages over vessels of all other nations. The bill is simplicity itself. It provides that upon all imports into the United States from foreign countries, or from the foreign possessions of the country where foreign vessels are permitted to engage in the carrying trade between those possessions and this country, there shall be allowed a rebate of 10 per cent. of the duty imposed by law upon the goods carried in American registry. Three things are accomplished by the bill. Onerous tariffs are lowered, American ships and the ship building industry are encouraged and protected, and cheaper freights are assured, both upon imports and exports. It is apparent to any one who will consider the matter but a moment that the rebate allowed by the bill would be divided between the freight payer and the freight carrier. It is my purpose to discuss this measure in the house at an early date. It may not be out of place to call attention at this time, however, to the fact that during the fiscal year ended June 30, 1902, the United States collected in customs duties $254,444,708. Had there been sufficient ships of American registry to have carried the goods imported to this country they would have been aided by rebates amounting to $25,444,470. This would have enabled them to practically monopolize the carrying trade of the world. No inconvenience would have resulted to the United States, since our surplus revenues for the same fiscal year aggregated the enormous sum of $91,287,375. The enactment of this bill into law would do violence to no democratic theory of government; it would avoid the vice of all proposed subsidy schemes and it would insure—what all Americans earnestly desire—the supremacy of our merchant marine."

BELLEVILLE BOILERS FOR IRONCLADS.

Two large battleships, each of 19,000 H. P., the Vittorio Emanuele and Regina Elena, recently ordered by the Italian navy and to be constructed at the works of Orlando Bros. of Livourne and Odero of Sestri-Ponente, will be supplied with Belleville water-tube boilers—twenty-eight boilers in each ship. The boilers are to be of the economizer kind. The Italian officials have selected the Belleville boilers for these two most important ships of their navy after giving very careful attention to results obtained with boilers of the same type in the coasting steamer, the Varese, of 13,500 H. P.

Work has been started on the steamer schooner San Gabriel, the first steel vessel to be constructed in Oakland harbor, California. The vessel is being built at the ship yard of the United Engineering Works. The San Gabriel will be 165 ft. long, 33 ft. beam and 13 ft. deep. She will have a carrying capacity of 500,000 ft. of lumber.

SHIPPING AND ENGINEERING NOTES FROM SCOTLAND.

Glasgow, Jan. 16, 1903:—Some considerable new orders have marked the beginning of the ship building year. The Union-Castle Mail Steamship Co. has contracted for three large and fast mail boats for their South African service, in addition to what they have already building. One of these is to be built by the Fairfield Ship Building & Engineering Co. of Glasgow, another by Barclay, Curle & Co. of Glasgow, and the third by Harland & Wolff, of Belfast. It is also reported that Harland & Wolff are to build six new vessels of 10,000 to 12,000 tons each for the Morgan combine. Some other contracts for liners are also being negotiated, but there is no prospect of revival in the demand for ocean tramps. And in the ship yards generally preparations are being made for a spell of slack times. It seems that the Fairfield company after all, is not going to build one of the two new Cunarders, as previously announced. The parties joined issue on the adjustment of terms and the order has been transferred to C. S. Swan & Hunter of Newcastle-on-Tyne, who built the big intermediate boat Iverma for the Cunard company. They are not engineers, but the machinery will be supplied by the Wallsend Engineering Co., the present manager of which was manager with the Fairfield company at the time when they built the Campania and Lucania engines. The founder of the firm of Swan & Hunter (which dates from 1872) was a member of the firm of C. Mitchell & Co., ship builders, when that concern amalgamated with Sir W. G. Armstrong & Co., making it Armstrong, Mitchell & Co. before another amalgamation with the Whitworth company caused the alteration of the title to its present form, Sir W. G. Armstrong, Whitworth & Co., Ltd. Mr. Swan preferred organizing a new concern to being absorbed in the combination, and the fame of Swan & Hunter has become world-wide. The other Cunarders will be built, as before announced, by Vickers Sons & Maxim, Ltd., at Barrow.

The project for erecting a permanent memorial to James Watt, the father of steam engineering, is creating a great deal of interest here. Mr. Andrew Carnegie has offered to give a sum of £10,000 toward a monument that shall be of some practical use as well as a record, and many other large subscriptions are promised. The trouble is what form the memorial should take, and the decision on this point will no doubt largely condition the public subscription. The Hon. J. C. Burns, son of the late and brother of the present Lord Inverclyde, chairman of the Cunard company, proposes that no better memorial could be founded than an experimental tank for ship builders and engineers, and this proposal is largely favored. On the other hand, it is contended that such a tank would only be of practical benefit to a part of mechanical engineering, and that a memorial to James Watt should take a form of interest and value to all using steam power. The larger design is to make the memorial an international one—such as a college of research, or an institute to aid invention. However, an interesting discussion has been started and some good result will certainly follow.

American readers will be interested in a few details I am able to give of the two new battleships for Chili, which are being launched this week—one by the Vickers Sons & Maxim and the other by the Armstrong, Whitworth & Co. They are sister ships and the design in them is a blend of battleship and cruiser. To take the Vickers ship, she is of 11,800 tons displacement and meets the view of those who consider it a mistake to have fighting units very large and costly. Only a first-class nation with extensive financial resources can afford to build battleships of 16,000 and 17,000 tons with the cost running up to about £1,125,000 sterling, or in the case of the new French battleships of 14,685 tons to as high as £1,420,000 sterling. At the admiralty there is a minority in favor of smaller ships, and the new cruisers of the Duke of Edinburgh type, which have greater offensive power than the Drakes or Powerfuls, and are yet smaller, are looked upon with favor. On the continent the tendency, except in one or two countries, is to follow the British lead by slightly increasing displacement, and generally there is inclination to give greater importance to the item of speed, notably in Italy, where it is held that the policy of the relative weaker nation, financially and military, is to endow their ships with such a speed that they could run away from a formidable enemy or engage in a fight if there were any chance of success.

With modern hardened steel it is possible to considerably extend the area of protection, and save weight. This saving can be utilized in improving the secondary guns rather than in increasing the area of protection. Austria, Italy and several other powers have slightly reduced the caliber of the primary gun, but have increased the power of the secondary weapon. In the Italian ships there are twelve 8-in. guns and in the Austrian ships eight 7.5-in. weapons, in addition to four 9.4-in. guns. In the Chilian ships the same conditions will prevail, but with a considerable increase in the number of guns, there being four of 10-in. caliber, with fourteen of the new 7.5-in. type, while the smaller guns are in excess of anything to be found in recent battleships. Each ship has the power of the battleship as far as aggressive action is concerned, notwithstanding restricted dimensions, and is fast, the sea speed being 19 knots. For size, the new ships are probably the most powerful yet built. One round of shot from all the guns on board means the discharge of 5,800 lbs. of projectiles, varying from 500 lbs. downward. The ships will discharge about 13½ tons of projectiles per minute, whereas the best done by any other ship of approximately the same or even up to 13,500 tons is only 9 tons. The 10-in. guns, with which each ship is fitted, fire four shots per minute of a weight of 500 lbs. each, with a muzzle energy of close upon 28,000 ft.-tons, while the 7½-in. guns will easily fire in action seven rounds per minute, the shot being of 200 lbs. weight, and the energy over 12,000 ft.-tons. At half a mile range the 500-lb shots could penetrate the broadside armor of any vessel, while the 200-lb. projectile would get through 6 in. of armor at 1,000 yds. range. The bow fire of the gun is equal to over six tons in weight, and the energy aggregates over 845,900 ft.-tons. As the Chilians have had experience of torpedo boat attack, they have installed a very large number of light guns, with the result that 280 projectiles of 14 lbs. weight, 112 of 6 lbs. weight, with something like 1,000 1¼-lb. shells and 2,000 rifle bullets may be fired per minute at any attacking force.

All the guns are placed within a citadel extending for 250 ft. to 260 ft. in the central part of the ship. This citadel is formed of 7-in. broadside armor extending to the upper deck from well under the waterline, while at the ends there are bulkheads of greater thickness and angled so as to offer still greater resistance to broadside attack. In the apex at the angles at each end there is fitted in the center line of the ship a barbette of 10-in. armor, and within this barbette there are mounted, in pairs, the 10-in. guns. At each of the four corners of the citadel on the upper deck there is placed in a casemate of 7-in. armor a 7.5-in. gun; the other ten of these guns are placed on the main deck behind the broadside armor, and above them are armored partitions. Forward and abaft the citadel there is waterline protection to the hull for a considerable depth, consisting of armor plating tapering to 3 in. as a minimum thickness. With two protected decks right fore and aft, the ship is exceptionally well armor clad.

The machinery consists of two triple-expansion, four-cylinder engines working on four cranks to minimize vibration, and these will develop together 12,500 H. P., which it is expected will give a speed of 19 knots. The boilers to be fitted are of the Yarrow type, with large tubes, while round them and affording additional protection to the machinery there are coal bunkers with a capacity to enable the ship to steam for over 12,000 sea miles at cruising speed. The displacement is 11,800 tons, the length of the vessel 435 ft., the beam 71 ft. and the draught 21 ft. 7½ in.

The bulk oil steamer Phoebus, built by David J. Dunlop & Co., Port Glasgow, for the Deutsch-Amerikanische Petroleum Gesellschaft of Hamburg, was taken on progressive trials a few days ago. The dimensions of this steamer are: Length between perpendiculars, 420 ft.; length over all, 435 ft.; breadth molded, 53 ft.; depth molded to upper deck, 32 ft. 6 in.; while the extreme molded depth to shelter deck is 39 ft. 9 in. The gross registered tonnage is about 6,200, while the total deadweight carrying capacity is about 8,500 tons. The Phoebus is of the most modern construction of oil steamer, with her engines amidships, and the tanks for oil fore-and-aft of the space occupied by machinery, boilers and bunkers The hull is divided transversely by bulkheads forming four cofferdams and eight main oil tanks, those tanks being again divided longitudinally by a fore-and-aft bulkhead extending right through them and continued into the hatchways to the shelter deck. The forward cofferdam separates the oil from the fore hold; the two middle cofferdams separate at the fore end the bunkers from the oil carried; the aft one protects the after end of the engine room; and the further aft cofferdam separates the oil from the after compartments of the vessel. The shaft tunnel which extends from the engine room to the after part of the steamer, and which must be absolutely oil and watertight, is of circular form, access to it being through a trunk leading from the shelter deck, as no communication is allowable from this part of the vessel to the engine room on account of the danger that might arise from any slight leakage of oil or gas into the tunnel. All the tanks and cofferdams in the steamer have to withstand a pressure equal to a head of water of 20 ft. from the tank deck. This test gives a pressure of about 20 lbs. to the square inch on the lower parts of all the bulkheads and shell of the vessel, all the parts being proportioned to withstand this pressure. The testing of the tanks, which was all done while the vessel was on the stocks, was carried out in the shortest possible time, considering that about 1,200 tons of water had to be moved every twenty-four hours by the vessel's pumps. In carrying out the construction of the vessel a large proportion of the internal work was done by pneumatic riveting, while the whole of the caulking—both in shell and tanks, which proved entirely satisfactory—was done by pneumatic tools. The pumping appliances consist of four duplex Snow pumps of special design and construction, one large and one small pump being placed in each of the pump rooms forward and aft in the steamer, the total capacity of the pumps being equal to loading or discharging 7,500 tons of oil in twelve hours. Bunker capacity is also provided in the vessel for about 1,000 tons of coal. The vessel is lightly rigged as a fore-and-aft two-masted schooner, with derrick on each mast and steam winches for handling light cargo or barrels. The outfit for the working of this oil carrier includes a combined steam and hand windlass with overhead capstan, three steam winches, steam steering gear, and full installation of electric light for all living

apartments, tanks, engine room tunnel, etc., and all rooms have also been arranged for being heated by steam.

The propelling machinery consists of one set of triple-expansion engines, having cylinders of 20, 48 and 78 in. diameter with 54 in. stroke, steam being supplied by three double-ended boilers, 17 ft. 2½ in. long by 14 ft. 6 in. mean diameter, having 18 furnaces in all, all proportioned for a working pressure of 170 lbs to the square inch. A large auxiliary boiler, 11 ft. long by 10 ft. diameter, is fitted on the upper deck for supplying steam to the petroleum pumps and to all deck machinery, and for the electric light. This boiler is also proportioned for working at 170 lbs. pressure. The hull and machinery have been built to Lloyd's highest class, under their special survey, while the boilers and machinery have been built to conform to the German law. A complete system of ventilation is provided to all parts of the vessel, and special attention has been given to tanks, cofferdams, tunnel, etc. Where oil or gas could accumulate, two large fans, one in each of the pump rooms, are fitted, and so adapted as to exhaust all the air or gas from such parts of the vessel.

At a meeting of directors of the Glasgow Ship Owners' Association this week the following resolution was passed: "That this meeting of directors of the Glasgow Ship Owners' Association, having had before them the report of the select committee on steamship subsidies, desired to urge upon the government to take into consideration the findings of the committee, and that at an early date they should act upon the opinion expressed in clause 42 of the report—that the whole of the light dues might fairly be abolished and the cost defrayed by the nation; and also the recommendation in clause 50 of the report, that the light dues should be abolished."

And in this connection the report of the directors of the Clyde Steamship Owners' Association bears that the composition of the lighthouse boards of England, Scotland and Ireland has for many years engaged the attention of ship owners' associations throughout the country. Although the board of trade has been repeatedly approached on the subject the only concession granted was the appointment of a committee of ship owners, merchants and underwriters to advise the board of trade in regard to proposed new work. While only a few years have elapsed since this committee came into existence, the result of its labor has more than convinced those interested that their belief as to the unsatisfactory manner in which the lighthouse fund was administered was not ill-founded. Advantage was taken of the annual meeting of the chamber of shipping to again consider the whole subject, and at the suggestion of this meeting the ship owners' parliamentary committee drafted a bill proposing that the administration of all property vested in the Trinity House, the commissioners of northern lighthouses and the commissioners of Irish lights should be transferred to the board of trade, the latter to be assisted by an English, a Scotch and an Irish committee to be appointed by the board of trade, the majority of each of those committees to consist of persons representative of the shipping trade of each of the three countries. It was also resolved that the time had arrived when a further effort should be made to get the light dues abolished, and a clause was accordingly inserted in the bill providing that the maintenance of lighthouses, etc. should in future be borne by the exchequer.

MEASURES OF IMPORTANCE TO SHIP BUILDERS

Speaking before the ways and means committee of the house of representatives on the Lovering drawback bill—a bill to rescind the duty on manufactured material intended again for export—Mr. Charles H. Cramp said that American ship builders are at present under a great disadvantage in competing with foreigners owing to the high price of all domestic material. He urged the passage of the bill, saying among other things.

"This bill is of great importance to the ship builders of this country, and of much more importance at the present time than ever before in the history of the country. Five or six years ago the cost of materials in this country was at the same level, and in some cases lower than abroad. Steel shapes and plates could be bought at Pittsburg at 1 cent per pound, and American manufacturers were shipping enormous cargoes abroad. Since that time an industrial evolution has occurred in this country, the extent of which can hardly be appreciated. Not only have materials doubled in price, steel being worth 2 cents per pound today instead of 1 cent per pound, but labor has gone up 30 or 40 per cent. The Dingley bill contained an important drawback provision for the Amercian ship builder constructing ships, for while a ship yard can buy finished articles abroad and import them for use in the construction of a ship and get the drawback upon the delivery of the ship, you cannot buy in the domestic market and use with benefit of drawback any article manufactured in the United States out of imported materials. As an illustration, the treasury department refused to allow drawback of duty paid on foreign billets imported and manufactured into boilers for a Russian battleship built by our company, a fact that added several thousand dollars to the cost of that ship. The importance of that branch of our business devoted to the building of ships for foreign account and the difficulties we now labor under in competing with foreign ship yards should certainly be understood by this committee. Owing to the hard times abroad the price of materials has gone down until today they are about $27 per ton, whereas the American ship builder must pay about $45 per ton. Yet we must compete for the construction of foreign ships, for our industry has grown to such an extent that there are at least four concerns, any one of which could build all the ships currently needed in the coastwise trade of this country. The ships being built for the export trade today aggregate 30 or 40 per cent. more in tonnage than ships for the coast trade. Thus you will see that anything that will reduce the cost of the materials entering into a ship built for foreign account is of the utmost importance to our entire industry.

"There is another point that should be remembered with regard to the American ship building industry, and that is that, because of its limited volume the yards in this country are not able to specialize as can be done abroad. In one of our large yards you may find five or six different classes of vessels in course of construction at the same time, a battleship, a cruiser, a boat for river and harbor business, a vessel for the West Indies trade, etc. Now the result is that the attention of the establishment cannot be directed to producing work cheaply, because there is such a division of the facilities of the plant in order to give good results in the construction of all the ships. In Great Britain it is different. Certain yards are devoted to building nothing but cargo boats of enormous size, which, of course, they will build much cheaper than other yards which do not make a specialty of such ships. We sometimes see it stated that the cost of ship building in the United States is 50 per cent. higher than in Europe, but such comparisons are made between our yards in which all kinds of work is done and British yards where specializing is carried to the utmost limit. Take the Elder's yard, which is equipped for building high-speed boats for the transatlantic trade, and ask them to compete on a cargo boat, and you will get a figure at least 20 per cent. higher than could be had from a builder on the east coast of England. This economy is secured by reason of the great bulk of business done, and we cannot specialize in this country until we can have the large volume of trade, which cannot be secured unless we can get help from our industry. The pending bill would be a long step in the right direction, and would be of great benefit not only to ship builders, but to domestic manufacturers of all the articles that go into ship building, which they could produce in this country with benefit of drawback and thus obviate the necessity of their importation in a finished form."

PRODUCTION OF PIG IRON IN 1902.

The Bulletin of the American Iron & Steel Association has received from the manufacturers ample statistics of the production of all kinds of pig iron in the United States in 1902. The total production of pig iron in 1902 was 17,821,307 gross tons, against 15,878,354 tons in 1901 and 13,789,242 tons in 1900. The increase in production in the second half of 1902 over the first half of the year was 204,159 tons. The total increase in 1902 over 1901 was 1,942,953 tons. The Bulletin says:

"It is remarkable that there should have been such a large increase in production in 1902, when there were serious adverse conditions to contend with, chiefly inadequate transportation facilities, resulting in a short supply of coke and iron ore and the banking for longer or shorter periods of many furnaces. The anthracite coal strike also seriously interfered with the activity of many eastern furnaces."

The production of Bessemer and low-phosphorus pig iron in 1902 was 10,393,168 tons, against 9,596,793 tons in 1901. Of basic pig iron, 2,038,590 tons were made, against 1,448,850 tons in 1901. The output of charcoal pig iron was 378,504 tons, against 360,147 tons in 1901. The production of mixed charcoal and coke pig iron was 11,665 tons, against 23,294 tons in 1901. Of spiegeleisen and ferro-manganese there were made 212,981 tons, against 291,461 tons in 1901.

In 1901 this country made more pig iron than Great Britain and Germany combined, and in 1902 the United States made more than these two countries and Belgium combined.

The stocks of pig iron which were unsold in the hands of manufacturers or which were under their control at the close of 1902, and were not intended for their own consumption, amounted to 49,951 tons, against 70,647 tons at the close of 1901 and 442,370 tons at the close of 1900.

The American Pig Iron Storage Warrant Co. held no pig iron whatever in any of its yards on Dec. 31, 1902. This is the first time since its organization in 1889 that the company has not held at least a small quantity of pig iron in its yards at the close of a calendar year. At the end of 1901 it had 3,000 tons. The whole number of furnaces in blast on Dec. 31, 1902, was 307, against 266 on Dec. 31, 1901, and 232 on Dec. 31, 1900. Of the 17,821,307 tons of pig iron produced in 1902 the five largest producing states were: Pennsylvania 8,117,800 tons; Ohio, 3,631,388; Illinois, 1,730,220; Alabama, 1,472,211; Virginia, 537,216.

Cobb, Butler & Co., Rockland, Me., have laid the keel for a passenger propeller. The company is now engaged in making a model of a steamer for the Vinalheaven and Rockland Steamboat Co., to replace the Gov. Bodwell. She will be 120 ft. long.

GROWTH OF IRON ORE TRADE.

The total shipments during 1902 were 27,571,121 gross tons—Tabulated statement of shipments from all Rivers—How the trade has grown.

Accompanying this issue of the Review is a tabulated statement showing the shipments from all the Lake Superior mines since the discovery of iron ore in 1844. The figures are of amazing interest. It was held to be an astonishing thing when in 1901 a total of 20,589,237 gross tons were moved; but the figures of 1902 show a tremendous gain over that enormous total. The total lake and all-rail shipments for 1902 reached the figure of 27,571,121 gross tons. This is exclusive of 298,420 tons which were shipped from the Clergue mines in the Michipicoten district in Canada. Of this Canadian ore 205,498 tons of it were shipped to Lake Erie ports and the remainder to Canadian ports. The all-rail shipments were 531,952 tons in 1902 as against 431,715 tons in 1901 and 489,078 tons in 1900. The amount moved by water during 1902 was 27,039,169 tons against 20,157,522 tons moved by water in 1901.

Every range displays a definite increase over the shipments of 1901 but the great gain is shown in the Mesabi range. From this giant body 13,342,840 tons were shipped as against 9,004,890 tons in 1901, an increase of 4,337,950 tons. It is interesting to note that 58 5/10 per cent. of the total shipments are credited to the United States Steel Corporation. The Steel Corporation contributed 16,136,787 tons. In addition the Steel Corporation takes half of the output of the Pewabic mine which shipped during 1902 a total of 530,291 tons. One-half of the Pewabic is owned by the Carnegie Steel Co. A quarter interest in the Queen group and Lake Superior mines, Marquette range, while included in the grand total of the Steel Corporation, actually belong to the Cleveland-Cliffs Iron Co., which owns a quarter interest in both of these properties. In the Queen group the quarter interest amounts to 102,011 tons and in the Lake Superior to 208,199 tons.

While the Mesabi range was only discovered eleven years ago it has already outstripped all ranges except the old Marquette, and another year is likely to see it forge ahead even of that range. The score at present stands 53,747,807 tons for Mesabi and 66,700,483 tons for Marquette.

The output of 27,571,121 gross tons of iron ore from mines of the Lake Superior region in 1902 is truly wonderful. The increase over 1901 is almost equal to the entire output of 1894 as the shipments in that year, then looked upon as quite large, footed up only 7,748,000 tons. The ore business of 1902 is one hundred-fold greater than in 1864 and fifty times what it was in 1869. It is twice the business of so recent a year as 1898—four seasons back; and of the 219,579,342 tons mined and shipped since the opening of the first Sault canal in 1885, half took forty-two years and the other has been the work of the past six seasons. Following is a table of shipments since the canal was first opened in 1855:

Year	Total Shipments.	Year	Total Shipments.
1855	1,449	1879	1,375,691
1856	36,343	1880	1,908,745
1857	25,646	1881	2,307,005
1858	15,876	1882	2,965,412
1859	68,832	1883	2,352,840
1860	114,401	1884	2,518,693
1861	49,909	1885	2,466,642
1862	124,169	1886	3,565,144
1863	203,055	1887	4,762,107
1864	243,127	1888	5,063,877
1865	236,208	1889	7,292,643
1866	278,796	1890	9,003,725
1867	473,567	1891	7,071,053
1868	491,449	1892	9,072,241
1869	617,444	1893	6,065,716
1870	830,940	1894	7,748,312
1871	779,607	1895	10,429,037
1872	900,901	1896	9,934,828
1873	1,162,458	1897	12,464,574
1874	919,557	1898	14,024,673
1875	891,257	1899	18,251,804
1876	992,764	1900	19,059,393
1877	1,015,087	1901	20,589,237
1878	1,111,100	1902	27,571,121

The shipments during 1902 from the different ports, from the different ranges and from each of the mines were as follows:

Shipments by Ports and All-Rail.—Gross Tons.

	Gross tons. 1902.	1901. Gross tons.	1900. Gross tons.	1899. Gross tons.
Escanaba	5,413,704	4,022,668	3,436,734	3,720,218
Marquette	2,595,010	2,354,284	2,661,861	2,733,596
Ashland	3,553,619	2,886,252	2,633,687	2,703,447
Two Harbors	5,605,185	5,018,197	4,007,294	3,973,733
Gladstone	92,375	117,089	418,854	381,457
Superior	4,180,568	2,321 077	1,522,899	878,942
Duluth	5,598,408	3,437,955	3,888,986	3,509,965
All-Rail	531,952	431 715	489,078	350,446
Total	27,571,121	20,589,237	19,059,393	18,251,804

Shipments by Ranges.—Gross Tons.

	1902. Gross tons.	1901. Gross tons.	1900. Gross tons.	1899. Gross tons.
Marquette Range	3,853,910	3,254,680	3,457,522	3,737,010
Menominee Range	4,627,624	3 605,449	3,261,221	3,301,052
Gogebic Range	3,663,484	2,938,155	2,875,295	2,795,856
Vermillion Range	2 084,263	1,786,063	1,655 820	1,771,502
Mesabi Range	13,342,840	9,004,890	7 809,535	6,620,384
Total	27,571,121	20,589,237	19,059,393	18,251,804

MARQUETTE RANGE.

Mine.	Gross tons.	Mine.	Gross tons.
Bessie	5,007	Lake Superior	832,796
Beaufort	59,781	Lillie	79,919
Cambria	63,976	Negaunee	204,286
Champion	205,721	Princeton	118,048
Chester	24,874	Queen Group	418,044
Cleveland-Cliffs	1,104,864	Republic	157,646
East New York	38,761	Richmond	50,041
Hartford	7,440	Volunteer	32,736
Jackson	15,440	Winthrop	129,496
Lake Angeline	304,125		
Total			3,853,010

MENOMINEE RANGE.

Mine.	Gross tons.	Mine.	Gross tons.
Antoine	110,993	Hiawatha	74,596
Aragon	646,203	Hope	3,373
Armenia	100,864	Lamont	47,267
Baltic	64,664	Lincoln	7,747
Bristol	129,035	Loretto	128,300
Chapin	956,812	Mansfield	31,181
Columbia	186,798	Michigan	53,272
Commonwealth	112,704	Millie	25,935
Crystal Falls	195,555	Northwestern	1,324
Cundy	183,052	Paint River	10,383
Dunn	2,816	Penn Iron Mfg. Co.	273,443
Ethel (Hennepin)	14,455	Pewabic	530,291
Florence	130,798	Quinnesec	62,531
Foxdale	15,015	Riverton	215,850
Great Western	42,470	Tobin	55,238
Groveland	7,599	Verona	43,245
Hemlock	123,331	Vivian	40,384
Total			4,627,524

GOGEBIC RANGE.

Mine.	Gross tons.	Mine.	Gross tons.
Ada	8,555	Meteor	19,117
Anvil	135,502	Mikado	98,834
Ashland	301,824	Montreal	136,354
Atlantic	190,213	New Davis	31,530
Aurora	402,981	Newport	141,571
Brotherton	53,255	Norrie	1,080,032
Carv	136,895	Ottawa	26,141
Colby	22,526	Palms	32,113
Chicago	44,625	Pike	6,343
Harmony (Germ'a)	205,502	Sunday Lake	144,630
Hennepin	36,383	Tilden	468,672
Iron Belt	79,121	Upson	11,065
Ironton	8,555	Yale (West Colby)	26,043
Jack Pot	102		
Total			3,663,484

VERMILLION RANGE.

Mine.	Gross tons.	Mine.	Gross tons.
Chandler	645,786	Savoy and Sibley	322,241
Minnesota	275,168	Zenith	167,205
Pioneer	673,863		
Total			2,084,263

MESABI RANGE.

Mine.	Gross tons.	Mine.	Gross tons.
Adams	1,242,923	Leetonia	28,784
Aetna	196,316	Lincoln	87,908
Agnew	45,582	Longyear	22,788
Auburn	38,283	Mahoning	1,038,645
Biwabik	623,127	Malta	222,640
Chisholm	200,629	Minorca	35,499
Clark	350,799	Morrow	35,571
Commodore	65,833	Mountain Iron	1,421,456
Corsica	59,292	Oliver	5,131
Croxton	18,594	Laura	16,453
Day	106,516	Pearce	54,884
Duluth	150,220	Penobscot	209,531
Elba	207,454	Pettit	17,278
Fayal	1,919,172	Pillsbury	238,122
Franklin	111,085	Roberts	28,972
Genoa	399,719	Sauntry	249,837
Glen	23,875	Sellers	193,428
Grant	51,946	Sharon	224,526
Hale	54,289	Sparta	227,444
Hawkins	5,892	Spruce	543,203
Jordan	147,931	Stevenson	1,434,681
Kanawha	24,829	Union	103,522
Lake Sup. Group	766,311	Utica	9,009
La Belle	70,753	Wills	12,158

Total 13,342,840
Grand total 27,571,121

PITTSBURG FLEET JOINS THE ASSOCIATION.

During the week meetings have been held in Cleveland by the reorganization committee, appointed at the annual meeting of the Lake Carriers' Asociation in Detroit last week, to work out the details of the plan of incorporation. These meetings have been attended by Mr. Wm. Livingstone of Detroit, Capt. M. M. Drake of Buffalo, Harvey D. Goulder and H. Coulby of Cleveland. The other members of the committee are Mr. J. C. Gilchrist and Mr. Frank J. Firth. Mr. Gilchrist is away for his health and Mr. Firth was unable to attend. The committee made excellent progress and has met with the utmost encouragement. Tonnage is enrolling steadily. The committee held two conferences with Mr. Wolvin and on Wednesday he announced that the fleet of the Pittsburg Steamship Co. would enroll in the association. In addition the vessels, of which Mr. Wolvin is the managing owner, will also enroll so that it is practically assured that the association will be greater than it ever was. The reorganization committee was greatly delighted. The papers of incorporation have been taken out in West Virginia, the necessary 10 per cent. of the capital stock having been paid in for that purpose. No especial haste is being made to elect the board of directors because there is no necessity for it; but it is quite likely that the organization will be in perfect working order within the next twenty days. By the time the executive committee is appointed the situation as to freights and operating expenses for the season of 1903 will be better known than it is now. The meeting of stockholders to elect the board of directors will be held in Detroit. It is understood, of course, that it will not be necessary for all the stockholders to go to Detroit. The reorganization committee is now at work obtaining their proxies and the first board of directors will be elected by the reorganization committee after discussion with the stockholders. Mr. Livingstone will, without doubt, be elected president. He has been one of the most enthusiastic supporters of the plan of reorganization. As soon as the organization is perfected and the committees are in working order the labor question will be taken up with the labor organizations and settled for the season. The by-laws of the association contain a provision that no agreement, contract or obligation, involving the credit of the association, shall be made without the order of the board of directors or of the executive committee and that it shall be terminable within one year. The two most important provisions in the by-laws are those which define the powers of the board of directors and executive committee. They are as follows:

"The board of directors shall have the control and management of the business of the association, and in addition to the powers and authorities expressly conferred upon them by these by-laws, they may exercise all such powers and do all such acts and things as may be exercised or done by the association, subject to the provisions of the statute of these by-laws, and to any regulations which may from time to time be made by the stockholders, provided, however, that no regulation made by the stockholders shall invalidate any prior act of the directors which would have been valid if such regulation had not been made.

"The board of directors shall have power to impose annually against each stockholder on acount of tonnage owned or represented by him in existence at the beginning of the current fiscal year, dues in an amount to be determined by the board of directors, and the association shall have a first lien upon the shares and the certificates of stock representing the same for all dues imposed by the board of directors, and in default of payment of the same or any part thereof for thirty days after written notice to the owner as the same shall appear on the books of the association, the association shall recall and cancel any such certificate with or without possession, crediting the holder on account of the dues so imposed with the book value of the shares as the same shall appear at the beginning of the fiscal year, all without waiver of or prejudice to the right of the association to proceed for and collect the balance of dues for the current year. Provided, that in the event any stockholder of record shall have written notice to the treasurer of said association on or before the first of February in any year of withdrawal of any vessel or vessels owned or represented by such stockholder from participation in the benefits of the association with surrender or cancellation, of any stock issued on account of such vessel or vessels, such owner and such shares shall not be subject to dues in any future fiscal year unless the vessel or vessels shall be returned to the association.

"The board of directors shall choose from their own number an executive committee, five in number, so chosen as in the judgment of the board to give due and proper representation to the various interests in the membership of the association, and shall choose five alternates in like manner, the alternates in each instance being authorized to act in case of inability of the regular member of the committee to attend, and each alternate to be related specifically to a designated member of the committee, so that at each meeting, whether the regular member or the alternate attend, proper representation of all interests may be had. This executive committee shall have the authority in the interim between meetings of the board to discharge the business of the association, excepting in respect of any matters which the board of directors by specific declaration may withhold from its action; the action of the executive committee, however, shall be binding only by unanimous vote thereof if the same be demanded by any member of the committee; and in the event of a division of opinion and vote in the executive committee, either the majority or the minoriy shall have the right, through the president or secretary, or, on their refusing, then in their own name, to call a meeting of the board of directors to be held promptly."

LUMBER CARRIERS' ASSOCIATION.

At the concluding session of the Lumber Carriers' Association in Detroit on Thursday last the vote by which it was decided to hold carrying charges in abeyance until operating expenses could be more adequately determined was reaffirmed. Handling charges on lumber and prices of fuel are at present uncertain quantities. It was rumored that coal would be much higher in price than it was in 1902, and a committee, the names of which were not announced was appointed to ascertain if some concession could not be secured for lumber vessels. Committees that are to take up the matter of charges for loading and unloading were also appointed to report at the next meeting of the board of directors on the first Tuesday in February. Dissatisfaction was also expressed with the classification of lumber vessels by the marine engineers, and President George Uhler was petitioned to appoint a committee to meet with a committee of the Lumber Carriers' Association to arrange a new classification. Following were the committees appointed:

Loading committee—Edward Hines, J. A. Calbick, A. R. Sinclair, O. W. Blodgett, H. E. Runnels, C. H. Weeks, J. O. Nesson, L. S. Sullivan and J. J. Boland.

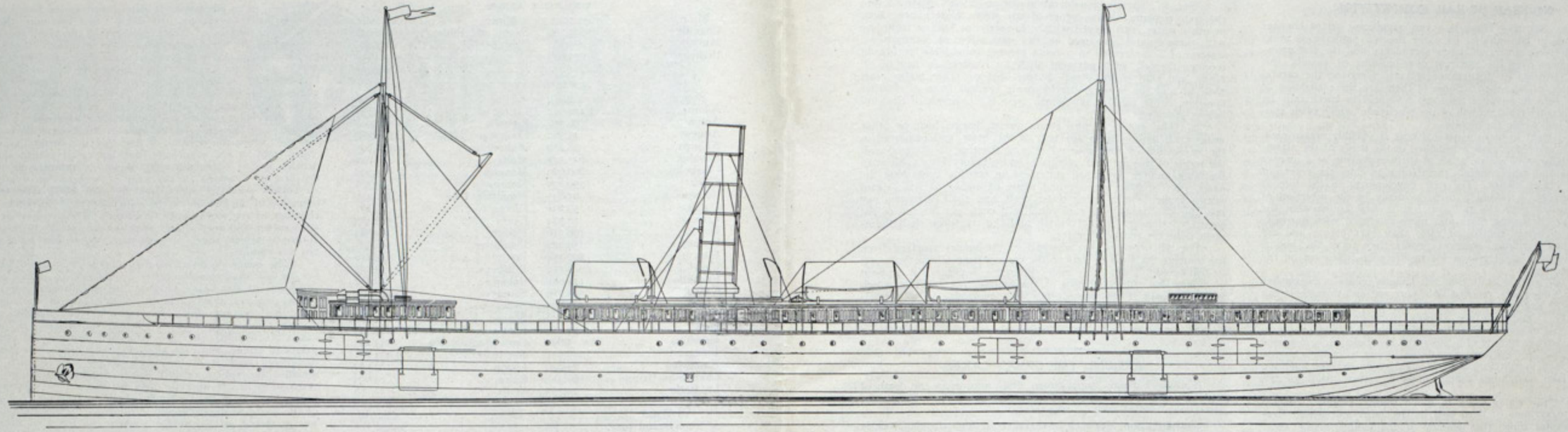
Unloading committee—W. H. Teare, C. E. Rowland, C. H. Prescott, Jr., L. S. Sullivan, E. L. Fisher, H. H. Lockwood, J. A. Calbick, C. W. Kotcher, Edward Hines, H. L. Wilton, Henry McMorran, J. J. Boland, W. D. Hamilton, C. T. Williams, V. T. Maschek, John W. Robinson, George Nestor, Guy White, W. H. Sharp, J. W. Ritchie.

Labor—W. H. Teare, C. W. Kotcher, J. O. Nesson, C. H. Prescott, Jr., W. D. Hamilton, O. W. Blodgett and J. A. Calbick.

DULUTH GRAIN SITUATION.

Mr. G. A. Tomlinson, vessel and insurance agent of Duluth, writes as follows of matters interesting to lake vessel owners:

"Receipts of grain at the head of the lakes are averaging 350,000 bu. a week and are comprised largely of flax and oats at the present time. Market conditions still prevent engagements for spring shipment, and it looks as though it will be some time before there is any inquiry for tonnage. Up to the present writing the temperature for the winter of 1902 and 1903 has been a little above the average for the last five years. The mean temperature for November and December, 1902, and to Jan. 21, 1903, has been 20.6, compared with 19.1 for the past five years. Notwithstanding, the ice in the harbor is 16 in. thick, or 3 in. greater than the average. Ice formed on Lake Superior two weeks earlier than usual. Today a field extends down the lake as far as the eye can reach. There is more snow around Lake Superior than for some years past. The prospects, therefore, so far as the ice is concerned, is for a much later opening than last year. Coal, both hard and soft, is being received by rail at the head of the lakes from the east and Illinois."



Single Screw Passenger and Freight Steamer for the Ocean Steamship Co., Savannah, Ga.

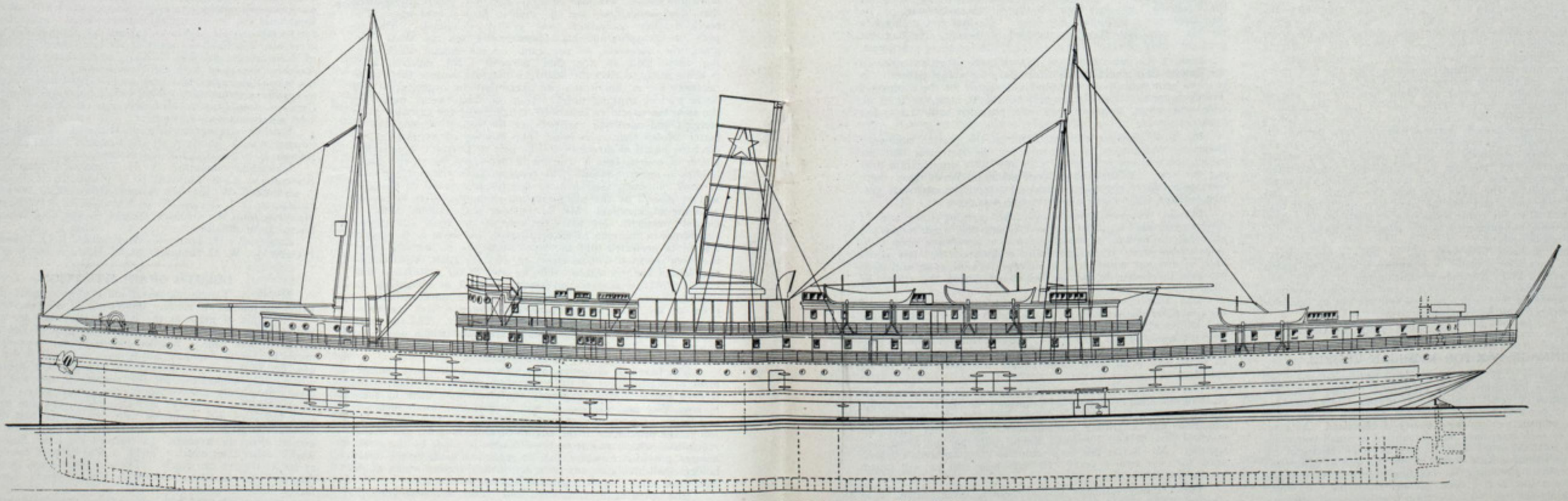
[*Building at Roach's Ship Yard, Chester, Pa.*

TWO FINE STEAMSHIPS

Roach's Ship Yard, Chester, Pa., is at present at work upon two excellent passenger steamers. The first is a single-screw vessel for the Ocean Steamship Co. of Savannah, of the following dimensions: Length over all, 396 ft.; beam, moulded, 49 ft.; depth to hurricane deck, 35 ft.; gross registered tonnage, 5,300. She will have a carrying capacity under beams of 375,000 cu. ft. and will carry on a given draught of water 3,500 gross tons of freight. She will have a speed of 13½ knots per hour. Her cabins are fitted for seventy-five first-class passengers and are to be finished in white and gold. The motive power will consist of a triple-expansion engine with cylinders of 28, 46, 75 in. diameter and 48 in. stroke, supplied with steam from four boilers, 15 ft. in diameter and 10 ft. 6 in. long. The steamer will be equipped throughout with up-to-date auxiliary machinery and will have facilities for handling freight with dispatch. In appearance and fittings she will resemble the City of Memphis of the same line, which was turned out at Roach's last May. She will in effect be a duplicate of the Memphis. The Memphis, with 500 tons more deadweight cargo capacity than the builder was required to furnish, has never fallen below her guaranteed speed, not even in the most severe and trying head gales known on the Atlantic coast, through which she has passed more than once. In a recent trial from Savannah the City of Memphis covered the distance between Savannah and New York, dock to dock, 720 nautical miles, in 52 hours and 30 minutes, averaging thereby a speed of 13.70 knots. She carries more cargo at greater speed and with less coal than was guaranteed and does it comfortably.

The second vessel is a twin-screw steamship for the New York & Texas Steamship Co. (Mallory Line) and is intended for service between New York and Galveston, Texas. She is of the following dimensions: Length over all, 400 ft.; beam, 53 ft.; depth, molded to hurricane deck, 35 ft.; gross registered tonnage, 5,500; cargo capacity under beams, 350,000 cu. ft. She is expected to carry 3,500 tons of cargo on a given draught of water. It is the expectation that she will cover the distance between New York and Galveston in about four and a half days. She will have accommodations for eighty first-class and forty-five second-class passengers. The first-class cabins will be fitted in hardwood and all the equipment will be in accordance with the latest design and finish. The propelling power consists of two direct-acting, triple-expansion engines, with piston valves actuated by the Marshall valve motion, having cylinders of 27½, 44½ and 70 in. diameter and stroke of 42 in. Steam will be supplied by three double-ended and two single-ended boilers, allowed a working pressure of 180 lbs. per square inch.

Hull model and equipment of both these steamers were designed by Mr. R. T. Dickinson, superintendent of the Roach yard; and the engines, boilers and general machinery by Mr. Thomas Mooney.



Twin Screw Steamship for the Mallory Line of New York.

[*Building at Roach's Ship Yard, Chester, Pa.*

NO FEAR OF RAIL COMPETITION.

Buffalo, Jan. 28.—There is a very significant set of changes taking place in lake affairs, let alone the well-understood move towards fleet concentration, labor ascendency and the fast-growing uneasiness over the apparent over-building of vessels. All these are elements of disturbance and are receiving the careful consideration of lake men. Some of them are the realization of tendencies seen in advance long ago and held in check only by the unexpectedly rapid growth of the lake trade, which made concentration impossible for awhile.

What I want to make a note of now is possibly not so plain to all, or it may have been overlooked in the study of the alarming conditions noted above, some of them appearing as a menace to all alike and others merely threatening to close the career of the small vessel owner. The new development in the line of trade expansion is taking a turn decidedly in the direction of lake supremacy over the railroads. It is well known that the railroads are becoming more and more swamped with business. They are in better control of rates than ever before and are sure of their earnings, however poorly they serve the public, this also being a good reason for indifference following on the heels of incapacity.

They tell us that grain that left Illinois points in November has not, in some cases, reached Baltimore yet, and this report can be duplicated endlessly with regard to practically every route in the country. Conditions are already alarming, for it is due largely to rail incapacity that the coal famine is raging, ready to become disastrous in case of a bad snow blockade. It is reported here now that the roads are already beginning to make a second choice of such freight as can be brought down by lake later on, although lake navigation cannot possibly return inside of ten weeks.

It takes the water route to move freight rapidly. Buffalo shipped 150,000 tons of hard coal in December and would have shipped several times that amount if the comparatively short rail lines from the mines to this port had been equal to the demand. Without the lakes it is found impossible to move any sort of freight at a rapidly increasing rate, no matter what the demand may be. So the Chicago hard coal dealers are saying now that they have little or nothing to sell and in some cases it is impossible to buy a full car load of soft coal there.

It appears that the roads are now inclined to give the lakes a chance, if only because they are obliged to, instead of stealing their business away from them as they used to, cutting the rates to get it if they could not get it otherwise. It is already given out that there will be a stiffening of lake rates in the spring, with some advance of commodity rates, all of which means that the lake fleet is not afraid of the all-rail competition, as it used to be. Here is an advantage and its opposite at the same time, but the shipper is not so much afraid of high rates as he is of delay, and he knows that an advance of rate will secure water transportation, which is not the case by rail.

And now comes one of the big milling companies—the Washburn-Crosby—to build a mill in Buffalo harbor with a capacity about equal to all the old ones and at once the town sees a stampede of other Minneapolis millers and is offering more water frontage for the same purpose. I asked an agent of one of the northwestern milling companies what the new move meant and he said that the milling company had of course found that it could handle its wheat and flour here for the eastern trade as it could not on the farther side of Lake Michigan.

This is especially true in winter, and never so true before as this winter, with nobody getting half the cars needed for carrying his freight. So it goes without saying that the rail situation will oblige everybody to use the lakes to their utmost capacity hereafter for massing up all possible non-perishable freight at points nearest to where it is to be needed and never get caught again as the trade has been this winter. It has been for a long time a fact that the lakes were much faster than the roads and when the roads come to a standstill, as they have nearly done now, in comparison to the demand on them, the difference is emphasized.

We shall probably have only two or three great package-freight lake lines after a little. It is known that all that stands between a sale of Hill's Northern Steamship line to the Pennsylvania or the Vanderbilt interest is the two passenger steamers, which are anything but money makers and are not as desirable as advertisers as they were expected to be.

JOHN CHAMBERLIN.

TONNAGE TAX FOR MICHIGAN VESSELS.

Representative J. H. Read of Manistee has introduced a bill in the Michigan legislature which proposes a change in the law for the taxation of vessel property. At present under Michigan law such property is taxed as personal property at the place where the company owning the property is organized. As a result many of such companies have organized in small communities, where local taxes are light, or they have left Michigan entirely. Representative Read would follow the lead of Minnesota and Wisconsin in providing for taxation according to tonnage. He proposes a low rate, 3 cents per net registered ton, which would certainly not meet with objection from the vessel interests. The text of the bill is as follows:

"Sec. 1. That in consideration for an annual payment into the state treasury by the owner of any steam vessel, barge, boat or other water craft owned within this state, or hailing from any port thereof, and employed in the navigation of international waters, of a sum equal to 3 cents per net ton of the registered tonnage thereof, such payment shall be received in lieu of all taxes, and said steam vessel, barge, boat or other water craft shall be and the same is hereby made exempt from all further taxation, either state or municipal, upon the payment of the sum herein provided.

"2. The owner of any steam vessel, barge, boat or other water craft hailing from any port of this state, and employed in the navigation of international waters, desiring to comply with the terms of this act shall, annually on or before July 1, file with the state auditor a verified statement in writing containing the name, port of hail, tonnage and name of owner of such steam vessel, barge, boat or other water craft, and shall thereupon pay into the state treasury a sum equal to 3 cents per net ton of the registered tonnage of said vessel, and the treasurer shall thereupon issue his receipt therefor."

The bill provides that one-half of the money received from the tonnage tax shall be paid to the county from which the vessel is registered. There is a wide difference between the amount of money that will be yielded by the tonnage tax and that which would be paid if the present law was applicable to all vessels owned by Michigan people. It is the difference between 3 cents per net registered ton and 2 per cent of the actual value of the vessel.

AROUND THE GREAT LAKES.

A dispatch from Amherstburg, Ont., announces the death of Capt. Trotter of that place. Some years ago he was among the best-known vessel men of the lakes.

Chicago grain shippers have taken a few vessels recently at 2½ cents for winter storage and spring delivery at Buffalo. This is a better rate than was expected some time ago.

Maj. D. D. Gaillard, United States engineer in charge of harbor improvements on Lake Superior, advertises elsewhere in this issue for the properly furnishing and placing about 26,000 tons of rip-rap at Ashland, Wis.

The Cleveland harbor of the Masters and Pilots' Association this week elected Capt. Matthew Mulholland, W. E. Moore and Frank Place as trustees. Special meetings will be held on Thursday afternoons for the purpose of taking in new members.

Benjamin L. Cowles, of Buffalo, has sold the tug Sandy Hook to the Donnelly Contracting Co. The Sandy Hook was formerly the passenger steamer Puritan and is well suited to towing scows engaged in dredging operation. She has been under charter to the Donnelly company for some time past.

Mr. William S. Canright, formerly purchasing agent of the Goodrich Line and later of the Northern Steamship Co., died at his home in Buffalo last week. He had gone to Florida for his health last May but received no benefit. He had not been connected directly with the lake trade for three years past.

Stanley B. Smith & Co. of Detroit have given an order to the Empire Ship Building Co. of Buffalo for a fuel lighter. It is to be built entirely of steel and is designed for the company's Toledo branch. The lighter will be 166 ft. long, 34 ft. 6 in. wide and 10 ft. deep. It is to be provided with 120 5-ton buckets.

Mr. E. I. Jenkins, vice president of the marine engineers' Beneficial Association, is authority for the statement that the association will not join hands with any other organization during the year. At the annual convention in Washington there was some talk of the masters and pilots and the engineers getting together but nothing along the line was done.

Freight representatives of all lake carrying lines and of their connecting railroads met at Chicago this week to discuss rates for the months of navigation and to determine upon divisions of revenue. It was generally understood that last year's basis of division, which is upon mileage in some cases and upon pro rate in others, should be maintained during the season of 1903.

Maj. Dan C. Kingman, government engineer in charge of the Cleveland district, has given the contract for the hull of the new harbor tug, which he is authorized to build, to Laird & Sons of Ashtabula and the contract for the machinery to the McKinnon Iron Works of Ashtabula. The tug will be 65 ft. long, 15 ft. beam and 8 ft. deep. The engine will have a 12 by 14 cylinder.

Henry C. Barter, secretary and treasurer of the International Longshoremen's, Marine & Transport Workers' Association resigned last week. The immediate cause of Mr. Barter's resignation was a trifling circumstance. Mr. Barter later announced that he and President Keefe could not get along well together. Mr. Barter has been with the Longshoremen's association for over twelve years. He says now that he will return to the docks.

The Dunkley-Williams Co. of South Haven, Mich., have engaged W. J. Wood, naval architect of Chicago, to inspect the construction of their new steel screw passenger steamer City

of South Haven, now being built by The Craig Ship Building Co., Toledo, O. The City of South Haven is expected to go on her run between Chicago and South Haven about June 15 next. A detailed description of her with plans will be published in the Review later.

Wreckage from the schooner Celtic, which was lost during a fierce gale on Lake Huron Nov. 29, has been found on Boom point, the extreme southeast end of Cockburn island. The Celtic broke away from the steamer Runnels during the storm, and nothing has ever been heard from the crew. Part of the wreckage is a yawl with two oars in the thole pins showing that the crew must have taken to the yawl. The captain's desk, with the ship's papers, was also washed up.

Maj. Thos. W. Symons, engineer for the Buffalo district, opened bids last week for improving the entrance to Black Rock harbor and the Erie basin. Five bids in all were received but they exceeded the government's appropriations of $800,000. The bids were as follows: James B. Donnelly, Buffalo, $1,848,000; Daly & Hannon Dredging Co., Ogdensburg, $1,071,500; Lake Erie Dredging Co., Buffalo, $1,020,500; L. P. & J. A. Smith, Cleveland, $1,179,500; Buffalo Dredging Co., $803,250.

Capt. D. D. Gaillard's report of commerce passing through the Portage lake canals for 1902 shows an increase of 17 per cent. in the volume of freight as compared with 1901 and an increase of 16 per cent. in valuation. The total freight was 2,532,325 tons and the valuation $65,326,818. The total number of vessels using the canals was 4,631 as compared with 3,921 in 1901. The registered tonnage was 2,550,493 as compared with 1,892,901 in 1901. More large vessels used the canals last season than ever before.

Harbor No. 63 of the American Association of Masters and Pilots was organized at the Sault Saturday night. The following officers were elected: Captain, George Hursley; first pilot, Thomas Hagen; second pilot, Joseph Taylor; purser, Frank Dolsen; captain's clerk, Stuart Ten Eyck; chaplain, Fred Tilley; first quartermaster, Charles Miniclier; second quartermaster, Samuel Ashmun; third quartermaster, Isaac Zess; fourth quartermaster, Neil Campbell; deck watchman, George Foster; saloon watchman, George McKenzie.

It is expected that the plans and specifications for the construction of a channel through the West Neebish rapids and waters leading thereto will be forwarded from the engineer's office in Detroit to Washington within a few days. It is likely that bids for the work will be opened in February and the contract let at once, and if this is done it would allow the contractor time to construct a considerable portion of the cofferdam necessary for the dry work through the rock cut this winter. The estimated cost of the channel via the West Neebish is $4,000,000, and once begun will be carried on uninterruptedly until completed.

At the annual meeting of the Licensed Tugmen's Protective Association held in Milwaukee last week the following officers were elected: President, Charles McCarle, Chicago; vice president, James Welsh, Duluth; second vice president, J. F. Page, Chicago; third vice president, L. S. Neubaus, Saugatuck; secretary, H. H. Vroman, Buffalo; treasurer, Peter Gagnon, Two Rivers. It is unfortunate that the association did not arise to its opportunity and restored to membership the men who fulfilled their contracts with the Great Lakes Towing Co. last year. These men may have made a mistake but they acted magnanimously and the association should have been as magnanimous as they. It was an opportunity which, had it been seized upon, would have cemented the association pretty thoroughly in the good opinion of mankind.

OFFICERS OF M. E. B. A. LODGES.

Manistee lodge No. 44.—Past president, Chris. Dahl; president, H. F. Otto; vice-president, Henry Hall; corresponding secretary, Geo. Layman; financial secretary, Wm. M. Martin; treasurer, Richard Winkler; recording secretary, John Nelson; chaplain, Martin Fleming; conductor, George E. Owens; doorkeeper, John Dellow; delegate to national convention, Wm. R. Patterson; alternate, F. R. Winkel.

Sturgeon Bay lodge No. 88.—President, Frank Bird; vice-president, Charles Katterfield; recording secretary, Geo. Baker; corresponding secretary, C. O. Chapman; treasurer, Frank Larsen; financial secretary, Julius Noll; doorkeeper, John Riley; chaplain, John McMillian; trustee for three years, John McMillian; representative to national convention, Frank Kimber.

Thunder Bay lodge No. 85.—Past president, Horace Carter; president, Wm. Hamilton; vice-president, Byron N. Persons; recording secretary, Allan E. Snyder; corresponding secretary, Samuel K. Kissack; financial secretary, Chas. Warwick; treasurer, Harry D. Irwin; trustees, T. H. Kneale, Richard Pupkom and Arthur J. Irwin; Chaplain, David McNeil; doorkeeper, John T. Oliver; grievance committee, A. J. Irwin, A. C. Calkins, David Thomson; executive committee, Harry Parker, Horace Carter, Chas. Miller, H. D. Irwin, T. H. Kneale.

Homeseekers' and Colonists' excursions to the west, northwest and southwest by way of the Nickel Plate road on the first and third Tuesdays of February, March and April, 1903. For low rates and particulars see nearest agent. E. A. Akers, C. P. & T. A., Cleveland, O. 285, Mar. 1.

OUR WARSHIP BUILDING CAPACITY.

Rear Admiral George Wallace Melville, chief of the bureau of steam engineering, in discussing the rapidity with which warships might be constructed in the United States, said this week:

"The question is mainly a matter of manufactured material. Unfortunately for a rapid building program there is an enormous amount of steel structural work going on in the United States today, such as bridging, iron for tunnelling and all sorts of modern buildings. There is no building of any considerable dimensions built today that is not filled with so much iron structural material as to keep our iron rolling mills more than full of work. Our plate mills and forges in the same manner are more than full of work. There are but two and possibly three. I doubt if there is a fourth forge in the country that has the capacity to make heavy marine engines and ship forgings which also applies to gun forgings which are parts of the make-up of the ship. The armor plate plants are limited to two. Possibly a third could be gotten into shape if the armor plate makers could be induced to spend the money to put down a plant or if the government would guarantee the armor plate makers enough work to make it worth their while. Thus you see, in the beginning it is more a matter of getting material than of building the ships. And even though all this material could be delivered to the ship builder as he demanded it, there is doubt in my mind that any ship builder in the United States could complete a 15,000-ton battleship or a 15,000-ton cruiser inside of three years, their boasts to the contrary notwithstanding.

"You can readily understand what a task it is to assemble the millions of parts that go into a ship, from her keel plates to her top sides, with her boilers and fittings of all kinds that no layman knows anything about. It would be impossible to gather a sufficient number of hands to collect these parts and put them in place in less time than I have stated. There is a limit to the number of men who can satisfactorily work on the same piece of work. They would interfere one with the other. Then again, take the accuracy with which every part of the ship is to be fitted. The 'cut and guess and try' system would not do. The work that goes into a battleship must be perfect. Now in regard to the number of ship building firms that could undertake government work. There are probably ten or twelve firms, not counting the navy yards that are fitted or could be fitted within six months to undertake the building of two large ships and finish these two ships in from thirty-six to forty-two months. Those firms include those on the Atlantic and on the Pacific oceans, some of which have government work in hand and some of which are prepared to do government work although they never have had it.

"At each of the navy yards on the Atlantic—Portsmouth, Boston, New York, League Island and Norfolk, Va., and on the Pacific at Mare Island and Bremerton there are good plants both in construction and steam engineering. They could start in with two ships each and some with four and as the work progressed tools and equipment could be added as needed. The ordnance department at the Washington navy yard without doubt where the forgings are supplied, could deliver the guns long before the ships were completed. The electrical equipment, which now is such a large part of the ship, would have to be taken by such firms as the General Electric, Westinghouse, Bullock and other concerns, which would grow on the strength of orders for government work. It must be borne in mind that all of these firms would be obliged to conform to rigid government specifications—the specifications given one firm would have to be repeated by every other firm that undertook to do government work, and by this system, and this system alone, could the work be pushed to a successful issue on such a tremendous scale as our government would require if confronted by a case of war.

"Besides the ship building plants and navy yards there are probably fifty smaller engineering firms that could take on government work for a smaller and lighter class of vessels, because after receiving contracts, if the forges, rolling mills and tool makers could deliver their products promptly, these smaller firms could enlarge their plants and complete the work in the time larger firms could complete larger contracts.

"Bear in mind, that after all, the whole progress of the work would depend on what is unfortunately the most scarce article in the labor market in the United States today, that is, well educated mechanical engineers and draughtsmen to make the necessary drawings and calculations for hulls and machinery, and the hundreds of thousands of competent mechanics whom we should have, but of whom there is a great dearth because of the absence of a proper system of apprenticeship. The lack of merchant work in ship yards at the present time would facilitate the completion of the government work, but it has always been observed that when the government is strengthening the naval fleet, an impetus is given to merchant ship building."

Perfect Passenger Service.—Every comfort afforded by the highest grade of modern train service is secured by travelers via the Nickel Plate road and its connections on the semi-weekly trans-continental tours, with berth rates less than one-half the price of regular Pullman car service. For particulars call on nearest agent. E. A. Akers, C. P. & T. A., Cleveland, O. 284, Mar. 1.

AIDS TO NAVIGATION.

A most interesting discussion by Col. Wm. P. Anderson, who has charge of Canada's danger warnings—Development of lighthouses, buoys, lightships, etc.

Lieut. Col. William P. Anderson, chief engineer of the Canadian department of marine and fisheries, lately delivered an address in Ottawa upon the subject "Modern Types of Danger Warnings in the Sea Coast. In it he practically reviewed in brief the history of the establishment of such aids to navigation. The address, however, was thoroughly modern and especially valuable as showing what the Dominion government is doing along these lines. Col. Anderson said:

"From the earliest dawn of commerce, which is coeval with the dawn of civilization, the necessity for danger warnings on the sea coast has been recognized. As long age as 300 years B. C. the pharos of Alexandria, the prototype of our modern lighthouse, was one of the seven wonders of the world, but this was crowned by the uncertain and rude light afforded by an open fire. The historic lighthouse of Corduan, at the mouth of the Garonne, built at the close of the sixteenth century, remains today, in point of architectural grandeur, the noblest edifice of its kind in the world. It, too, was first illumined by burning billets of oak in a chauffeur at the top. It was not until 1807 that the feeble light from a chandelier filled with 10 lbs. of tallow candles was supplanted in the famous Eddystone lighthouse by lamps, reinforced by paraboloidal reflectors, so that improved methods of lighthouse illumination began less than 100 years ago. Argand's accidental discovery that the superposition over an oil flame of a glass cylinder would, by increasing the draught, that is the supply of oxygen, vastly increase the brilliancy and steadiness of the light, was the first step in the improvement of illuminating apparatus. The direction of a considerable proportion of the beams of light by placing the flame in the focus of a paraboloidal reflector was the next progressive step, but the crowning improvement in the illuminating apparatus of lighthouses was the utilization by Fresnel of there fractive power of glass, when cut into properly shaped lenses, to direct the light into parallel beams. Since the days of Argand and Fresnel little has been done to improve the *theory* of lighthouse illumination. The principles adopted by them are still recognized as accurate, and progress has been in the direction of increasing the size and power of the apparatus, without departing from their general principles. Spermaceti oil obtained from whales, seal oil and various fish oils, as illuminants, gave place to Colza oil, a vegetable product, and it, in turn, has been displaced by petroleum, a much cheaper illuminant, and capable of producing a much larger and more brilliant flame. The English lighthouses burn petroleum in lamps having as many as ten concentric wicks, with an intensity of 2619 standard candles.

"Of late years many experiments have been made with a view to replace oil by coal gas, acetylene gas and electric light, but petroleum is still generally used. It has the advantage over other forms of illuminants of being cheap and easily stored, and of giving a light with a clear yellow color, which, it is claimed, penetrates fog better than the whiter lights obtained from more modern illuminants. In the endeavor to secure the best possible light producer many very powerful lamps have been invented, including a gas burner made by Mr. Wigham of Dublin, containing 108 gas jets. He has superposed three such burners in the foci of separate lenses in a single lighthouse. The difficulty of using this apparatus consists in the great heat evolved, as well as in the immense lantern required to contain the superposed lenses, and to give sufficient air for and ventilation to the flames. Mr. Wigham has lately utilized the Auer light principle in his multiple jet gas burners, and must secure very great illumination by this means. Mr. Emmerson of Ottawa, has shown me a lamp in which oil in a vaporized form is burned under an incandescent mantle. This promises a brilliant and cheap light, if mantles less fragile than those now in the market can be secured. Acetylene also promises good results, when a perfect gas generator shall have been invented. Heretofore so much practical difficulty has arisen in producing pure gas, in producing it economically in the small quantities required in a lighthouse, and in preventing the mechanism from freezing, that acetylene has not yet supplanted oil in any of our lighthouses.

DISADVANTAGES OF POWERFUL LIGHTS.

"Electric light can only be profitably employed when the supply can be drawn from a commercial source. To instal and run an independent plant at a light station is so expensive, and is accompanied by so many practical difficulties, that even rich lighthouse boards, like those of England and France, have extended the installation of electric lighthouses very slowly. In Canada we have a few lighthouses supplied by corporations producing electricity in large quantities. Advantage has been taken of the facility with which the electric current can be turned off and on, to make the light at Port Dalhousie occulting, by a simple clockwork; and to alternately light a lamp and operate a fog trumpet on a beacon in Victoria harbor. So far as I can ascertain, Canada is the first country that has utilized an alternating current in an occulted light, and Mr. Trudeau of Ottawa is the inventor of the first electric fog alarm. It has always been a question in my mind whether there was any great advantage in multiplying the initial intensity of light in the way in which the superposed burners and other large lamps do multiply it. In clear weather any ordinary good strong light is visible to the horizon of the lighthouse, and this is especially true of the clear atmosphere of Canada. In thick fog the most powerful light is entirely useless at a distance of a few hundred yards, a distance so short that no vessel could get the warning of the light in time to be saved from disaster; consequently it is doubtful if the aim of the inventors of these extraordinarily powerful lights, to secure greater penetration in thick weather, is attained; on the other hand, a very brilliant light in clear weather is a distinct disadvantage, blinding the sailor, and preventing him from judging his distance either from the light or from neighboring objects. I believe that the immense sums spent in the maintenance of extraordinarily powerful lights would be utilized to better advantage in increasing the number and power of fog alarms in the same district.

"Improvements in the illumination of lighthouses have been forced upon engineers by the growth in the size and speed of vessels. In the days of the old sailing ships, when shore lights were few and feeble, a powerful fixed light was a sufficient guide. In these days of 23-knot vessels, running through narrow, and often through dredged channels, when every city, and small town is illuminated by electric light, the fixed light, that was so brilliant under old conditions, is rendered insignificant by comparison, and it becomes necessary to provide a beacon more powerful, and one that by its character can be recognized as soon as seen. The head lights of electrically-lighted steamships are today as brilliant as many of the old fixed lights; this is another reason why it has been found necessary to adopt the principle of abolishing fixed lights altogether for the more important stations. To the improvement in lamps I have already referred; the improvement in optical apparatus has been in the direction of varying the character of the light, either by occulting it, or by gathering rays in to condensed beams by a suitable arrangement of lenses, thus giving a very powerful flash or groups of flashes followed by an eclipse. This flashing light can be very much diversified in character, but a description of the methods of attaining the results would be tedious if described technically. The flashes are produced by revolving an arrangement of the lenses around the lamp as a center, and much ingenuity has been displayed in the details for carrying round the heavy machinery with the least possible friction. Today ball bearings are used on small apparatus, while the largest and most quickly revolving apparatus are floated in troughs of mercury. The most perfect development theoretically of this system of concentration of the rays is the French invention known as the *feu eclair*. This light is based on the laws that the time which a flash takes to make an impression varies inversely as its intensity, and that once having made an impression a certain time is necessary to allow a steady light to produce its full effect, and that this time also varies inversely as the intensity of the light. It has been demonstrated that a very powerful beam will produce its full effect on the eye in the space of 1-10 second. Applied to lighthouses, this means that there is no advantage in making a flash of longer duration than 1-10 second, for this will allow it to be seen as a flash at the utmost distance at which it can possibly affect the eye, while as it is approached it will of course appear longer and stronger.

"In the *feux eclairs* the lenses are so designed as to gather the whole of the light into one narrow beam, and are revolved so rapidly as to give flashes of about a tenth of a second duration at intervals of ten seconds. The resulting speed of the revolving beam of light is very great. Seventy miles is not an extreme limit of visibility for the most powerful lights, and at that radius the beam is traveling at the rate of about 440 miles in ten seconds. Its width, therefore, to act on the eye, for a tenth of a second, must be nearly 4½ miles. To give the necessary divergence to the beam, an extremely large size of flame is required, and in practice it is found impossible to maintain a flame large enough to give extreme results. The sailor, who usually cares nothing about theories, does not seem to take kindly to the *feu eclair*. He complains that it is impossible to locate a flash before it disappears, and he prefers a light of which he can take a bearing while it remains visible. Therefore he favors less intense and longer flashes, but the general practice today is to greatly reduce the length of flashes and the dark intervals between them; and some of our old-fashined revolving lights, having a period of two or three minutes, are hopelessly out of date.

DEVELOPMENT OF FOG SIGNALS.

"The increase in speed of ships, to which I have alluded, and in the quantity of shipping, as well as the haste insisted upon in these days of close competition, have made it imperative that ships should push on through fair weather and foul, through clear weather and thick, and all our prominent turning points are piled up with the wrecks of the vessels that have cut the corners too closely. In the endeavor to protect vessels under these conditions fog alarms have become more and more necessary, and more and more relied upon as aids to navigation, and are now found upon most salient headlands. These

may be classified under four heads, namely, explosive signals, sounds produced by reed instruments, whistles and sirens.

"The one advantage of explosive signals is the facility with which they can be established. The necessary electrical connections can be made in a few minutes, and their installation costs practically nothing, especially since gun cotton exploded in the open air at the end of a mast, has taken the place of gunpowder fired from cannons. A disadvantage of an explosive signal is that the noise is so short in duration that it may be drowned in a local noise, lost in the noise of the waves, or of a storm, or even in the roar of the gale in the rigging; moreover, it is difficult to fire with safety so frequently as modern requirements demand; iff fired frequently expplosive signals become much more expensive than more powerful and prolonged noises produced at frequent intervals by machinery. requirements demand; if fired frequently explosive signals or compressed air fog sirens.

"The earlier trumpets and horns, operated by steam or air, were reed instruments, but these have been found less powerful than whistles and sirens and are being rapidly replaced by the latter, although good horns have given surprising results. On one ocasion I heard the horn on the Western islands, in Georgian bay, distinctly at Cape Croker, 26 miles distant, across a wind.

"It is questionable if any sound can be produced superior to the clear blast of a good steam whistle, and many of our best fog alarms are large whistles. The sound can be varied by changing the intervals between the blasts and by the use of various modifications of whistle bells. Chime whistles are used, as well as whistles containing a piston, which changes the length of the bell and consequently varies the note. These variable whistles are known as 'modoc' or 'wild cat' whistles.

"In the siren the sound is produced by forcing steam or air through small holes opened and closed very rapidly by the revolution on a perforated metal disk of another similarly perforated disk. By varying the number of openings or the speed of the revolution, the pitch or tone of the siren is changed. At Belle Isle I installed a 6-in. siren in 1899, giving alternately a high and a low note. The air compressors here are driven by a jet wheel, with water led from lakes on the hills of the island, and the compressed air is piped for 4,000 ft. to the horns. This alarm is of the largest and most powerful type ever installed at any station, and is the only example of a fog alarm run by water power.

"One disadvantage of all fog signals except steam whistles is that the trumpets throw the sound out in one direction, so that it is louder in the axis of the trumpet than in other directions. There seems, however, to be no way of overcoming this difficulty. American inventors have taken advantage of this direc- to the cardinal points. Through each megaphone it sends a different signal, with the exception that a vessel can judge the direction from which the sound comes by the relative loudness of the signals. We are now installing one of these Hamilton-Foster sirens at Fame point lighthouse on the Gaspe coast, the first landfall made by vessels after crossing the gulf inward bound, to experiment on this principle of judging sound direction. Even though the claim of the inventors, that the siren will indicate its own direction from the vessel, should be unfulfilled. the signal will give an efficient coast warning, acting as an ordinary siren.

"We meet with a good deal of difficulty and disappointment in operating our fog signals. This is because we cannot make mariners understand that sound signals are extremely liable to aerial disturbance. *Theoretically,* sound waves are propagated in straight lines in all directions from their source, exactly as light waves are propagated. *Practically,* these straight lines of sound waves are deflected by any little irregularity in the air through which they pass. If the air is not wholly homogeneous, the sound waves will not pass through it in straight lines, but will be deflected, and whether the deflection is down towards the surface of the water, or up into the air, the effect is the same; the sound does not travel parallel to the surface of the sea, and is lost to the sailor who is listening for it. A small island, a reef, or rocks, or even a shoal lying outside of a fog alarm station, will have the effect of unequally heating the air which covers them, and the air thus separated into strata of unequal densities, causes refraction of the waves of sound, and the fog alarm becomes ineffective. The same thing may happen, though it is not so likely to do so, where none of these natural obstructions are apparent Times without number complaint has been made that one of our fog alarms was not in operation, when investigation proved that it was sounding as loudly as ever, the trouble being with atmospheric conditions. Some of you may have noticed echoes produced where there was apparently no hill or surface to reflect the sound. These echoes must have been reflected from strata of air differing greatly in density from that at the point of production of the sound, and are one example of the difficulties that fog alarm signals strive in vain to overcome. For these reasons we warn mariners that they must never judge their distance from a fog signal, either by the power of the sound or by the absence of sound, because under certain conditions of atmosphere the sound may be heard loudly at long distances from the alarm; under other conditions it may be lost at a very short distance, and these conditions may vary at the same station within very short intervals of time or of space. Unfortunately it seems impossible to convince captains of this, and many wrecks have resulted from their ignorance of these well known aberrations.

THE EMPLOYMENT OF THE LIGHTSHIP.

"Danger signals that have been greatly improved in recent years are floating aids to navigation, including lightships and buoys. The modern lightship is a reservoir of complicated machinery, containing apparatus for revolving lights at the mast head; powerful fog signal machinery; auxiliary power for propelling the vessel, in case she breaks away from her moorings or is obliged to run for shelter, and mechanical appliances for relieving the strain on the anchor in heavy weather. A lightship, however, can in no way be considered as satisfactory an aid to navigation as a solidly founded lighthouse. because the motion of the waves prevents the light from being seen at a great distance, and in our climate a vessel must leave her station when ice forms, and is, therefore, unavailable at the time navigation is closing, when an aid is most urgentlv required; moreover she is liable at any time to break from her moorings, and may therefore not be found at the place expected. The one point in favor of a lightship is that her station may be so located that vessels can run much closer to her than they can to a light on land.

"In 1899 there was an international convention on the subject of buoyage, which resulted in the adoption of rules to govern the shapes and colors of buoys. Canada has adopted these international regulations, and all our larger buoys have been made to conform in shape as well as in color to these international regulations. To make the necessary improvements involved the furnishing of a large number of conical buoys. The ingenuity that has been shown in the development of signal buoys is most interesting. The earliest signal buoy is the old bell buoy. I doubt if this has been much improved since the eighteenth century.

"The Courtenay whistling buoy is a most successful, ingenious and original invention. It is fitted with a long cylinder reaching down into the sea below wave action. As the buoy rises and falls on the water this cylinder acts as an air compressor, the compressed air being forced out through a large whistle on the superstructure, and emitting a fitful and distinctive moan. We have now in the Dominion over thirty of these buoys, and are rapidly adding to the number.

THE PINTSCH GAS-LIGHTED BUOY.

"Another very successful and original buoy is the Pintsch gas-lighted buoy, in which a specially purified gas is compressed to 10 or 12 atmospheres, and supplied to a group of burners through a reducing valve so gradually that a large buoy will burn night and day for three months without attention. An ingenious invention in connection with this buoy is an automatic cut-off that withdraws the supply of gas at short intervals, so as to give the effect of an occulting light. This result is secured by alternately filling and emptying a chamber capped with a piece of flexible leather, and owes its success to the extreme simplicity of the mechanism. With this attachment there are tnree burners, which are extinguished, grouped about a small pilot burner, not affected by the cut off, and which relights the outer jets as often as the gas resumes its flow. Pintsch gas is largely used for lighting cars. The brilliant lights on the Canada-Atlantic trains between Ottawa and Montreal are Pintsch gas-lights, the tanks on the cars being supplied from a gas works in Montreal. This gas is also utilized in many small beacon lights.

"Many experiments have been tried in maintaining electrically-lighted buoys, and a dredge channel entering New York harbor, Gedney channel, is equipped with electrically-lighted buoys, but the system has not proved an unqualified success, as any damage to the cable extinguishes all the lights, and the cost of maintenance has been excessive. A proposition has lately been made to safeguard the River St. Lawrence between Montreal and Quebec by a similar system of electrically-lighted buoys. Any electrician will tell you how extremely expensive the installation would be, and how precarious the maintenance. The department sent the proposer of the scheme out on our steam tender this winter, when we were saving our ordinary buoys from the running ice, and I expect, after what he saw there, we shall hear nothing more of that scheme.

"We have had manv interesting experiences with buoys that have gone adrift from our Atlantic shore. It is nothing unusual to hear of them anywhere out in the open Atlantic. One has come back to us from Ireland, and we have heard of others in Spain and Africa. Our last prodigal was returned to us from Turks island in the West Indies, after being absent for about three years. This buoy must necessarily have made a long journey to have reached its destination. The only way in which it could possibly have reached the West Indies is by following the Gulf stream nearly to the coast of Ireland, down through the Bay of Biscay, past the Azores, the Cape Verde islands, and the African coast, and back to the coast of America through the equatorial ocean.

"There are many other aids to navigation such as hydrographic surveys, surveys of tides and currents, and the connec-

tion of lighthouses by telegraph with centres of commerce, which have been of great benefit to mariners, and of which an account might be interesting, but they can scarcely be classed as danger warnings, and are thus foreign to my subject. All the large naval powers are at the present moment experimenting with the Marconi system of aerial telegraphy, which the inventor claims will warn a vessel of the existence of danger more efficiently than any of the methods that are at present in use, but it remains to be seen whether the invention can be utilized in this way.

You may have noticed in the public press, during the year, many vigorous attacks on the lighthouse system of Canada. To read them one would think that all our lights and fog alarms were obsolete. If you make allowance for the immense extent of sea coast that we have to cover, for the youth of the country, and for the fact that all our aids to navigation are absolutely free to shipping, you will admit that Canada has accomplished a wonderful work, and one that should receive praise instead of censure, when I tell you that, since confederation, the number of our lighthouses has been increased from 227 to nearly 900, and of steam fog alarms from two to sixty-four. This large number of aids to navigation, besides thousands of buoys and other minor aids that have not been mentioned, are maintained at an annual expenditure of about $500,000. It is true that many of our lights are not strictly modern, first-class lights, but all of them are good, serviceable lights under ordinary conditions of weather, and our fog alarms are as modern and powerful as any in existence. We have the testimony of one commander-in-chief of the North America station after another to the efficiency of our system, and many of the recent attacks on it have been inspired by a few shippers having selfish ends in view. If our lights are not perfect, we are improving them and adding to their number every year, and are also establishing new fog alarm stations but even in their present condition they are ample to secure safety to a carefullv and intelligently navigated ship. What we in Canada require more than improvements in aids to navigation is education of the sailors and pilots frequenting our waters in modern methods of navigation.

TO SAVE FUEL ON STEAMSHIPS.

As practically all of the new ships now under way in lake yards are to be fitted with forced draft or induced draft systems for the saving of fuel, and which admit of the use of low grade fuel with most satisfactory results, it is interesting to note that the Great Lakes Engineering Works of Detroit, in preparing for the extensive ship building operations which they are to undertake shortly in a new yard on the Detroit river, have fortified themselves with rights to install a new system—new to the lakes but already in successful use on vessels of the Atlantic and Pacific coasts and in numerous stationary steam plants throughout the country. The svstem is known as the Hydro-Carbon system and is already being applied through the engineering branch of the Great Lakes works, which has for some time past been in full operation, although the ship yard is not yet completed. In view of the high prices that must be paid for steamboat fuel, as for coal of all kinds, this system is worthy of investigation by vessel men, principally on account of its low cost and the readiness with which it may be applied.

As an instance of the efficiency of the system, the following report from one of the big freighters of the Oceanic Steamship Co.'s fleet, San Francisco, just at hand, is published:

Extracts from Log of Steamship Zelandia, Oceanic Steamship Co., San Francisco, Cal.

RECORDS OF TRIP FROM SAN FRANCISCO TO HONOLULU.

	Without Hydro-Carbon System.	With Hydro-Carbon System.
Distance	2,091 miles,	2,086 miles.
Time	7d. 12h. 26m.,	7d. 2h. 15m.
Average speed per hour	11.56 knots	12.25 knots. (Average light headwinds)
Average revolutions per minute	53.7	59.1
Average steam pressure	67 lbs.	70 lbs.
Coal burned	385 tons,	368 tons.
Average coal per day	50.1 tons,	51.8 tons.
Quality	Soft, poor slack,	Soft, poor slack, 25% ash.
Smoke	Bad	None objectionable.
Gain		17 tons coal. 10h. 11m. time.

RECORD OF TRIP FROM HONOLULU TO SAN FRANCISCO.

Distance	2,074 miles,	2 080 miles.
Time	7d. 15h 30m.,	6d. 22h 57m.
Average speed per hour	11.31 knots,	12.46 knots, (Average fresh headwinds)
Average revolutions per minute	56.1,	60.4
Average steam pressure	70 lbs.,	71 lbs.
Coal burned	385 tons,	387 tons.
Average coal per day	51.7 tons,	55.6 tons.
Quality	Soft, good, Honolulu,	Soft slack, Honolulu, 25% ash.
Smoke	Bad	None objectionable.
Gain		16h 33m.

The last trip from Honolulu with the Hydro-Carbon system to San Francisco was made in 6 days 17 hours, which was the fastest trip of her history, though she is twentv-seven years old and over 400 ft. long.

Among well known large steam yachts to which the Hydro-Carbon system has been applied with marked success, are the Nourmahal, owned by John Jacob Astor, the Niagara, owned by Mr. Howard Gould, Mr. J. R. Dos Passos' Gaivota, Mr. E. R. Dick's Elsa and the Cynthia, owned by Com. Mills. Sommers N. Smith, vice-president and general manager of the Neafie & Levy Ship & Engine Building Co. of Philadelphia, and who is one of the best-known ship builders of the country, says of the system: "After going into the matter very thoroughly and taking account of the actual consumption of coal for eight weeks previous to the installation of your system and eight weeks after same was installed, we find a saving of 26½ per cent. in fuel. Furthermore, we are pleased to inform you that this device not only creates a saving in fuel, but also gives us much better combustion and far better steaming facilities. We are very glad that we are able to give you such a favorable report, and feel that we have given the apparatus a thorough test, and it has borne out everything we have stated in connection with it."

The system is thus described: "It is based upon natural laws and accomplishes its results in a simple manner. Its apparatus is easily applied to any type of boiler, for any steaming purpose, at a very moderate cost, without any change in the setting of the boiler or in the fire chamber or of the grate bars, and can be used or discontinued at any time without disturbing the fires. A specially-designed patented door apparatus is substituted for the ordinary fire door, so arranged that the air is heated first and passed into the fire chamber over the fire, and by a peculiar arrangement distributed in proper proportions (suited to varying conditions of fuel used or requirements), to form an induced draft, supplying to the carbon from the coal the needed amount of free oxvgen to change the conditions of the combustible gases from carbonic oxide to di-oxide and monoxide gases, thus obtaining from every pound of coal burned a great increase in heat units, largely decreasing the temperature of escaping gases in the chimney, and leaving in the ash pit only the clay residuum of the coal. The carbon laden smoke from soft coal is prevented, as the carbon is turned into combustible gases and heat units in the fire chamber. In addition, another element of heat is added to the coal by super-heating a small amount of steam in a heavy metal retort (of special design and material to withstand the heat) and disassociating the steam, thereby forming hydrogen gas, which is ejected into the fire chamber, in combination with the induced draft, thus forming a powerful adjunct and increasing largely the ratio of evaporation, owing to less frequent firing and use of slicing bars, less deposit of soot in or on tubes, and shell, and less ash to remove. Labor is saved, often dispensing with coal passers or giving the firemen more time for other duties."

Congressman Mann has introduced a bill in the house of representatives at Washington, as a substitute for the two joint resolutions he has before the house in reference to the Chicago tunnels. The bill declares the three tunnels under the Chicago river to be unreasonable obstructions to navigation, calls them public nuisances, and directs the secretary of war to give notice to the owners that they must be altered or changed as may be recommended by the chief engineers, and if not criminal proceedings shall be begun. After a reasonable time given by the secretary of war, if the changes are not made, there shall be a penalty of $10,000 a month assessed against each tunnel. Mr. Mann tried to get his new bill reported by the committee on interstate and foreign commerce, but the committee appointed a sub-committee to consider the measure, and Congressman McAndrews of Chicago inquired of Commissioner McGann by wire as to whether the city of Chicago desired to be heard. Congressman Mann's new bill was drawn in conformity with the opinion of Judge Advocate General Davis, and the suggestions of General Gillespie, chief of engineers of the war department. The judge advocate general, in giving his opinion as to the liability of the United States government, should congress decide to order the tunnels removed, says that the Chicago river is a part of the navigable waters of the United States and it is within the power of congress to compel the removal of obstructions to navigation. He cites decisions of the supreme court to sustain this declaration. He then says: "It matters little as to the character of the obstruction or the authority for its establishment, and whether it is a bridge across the navigable waters or a tunnel beneath them, if it be an obstruction to navigation it may be dealt with as such by the legislative department of the government."

Fire broke out a few days ago in Boston on the wharves owned by the Long Wharf Corporation and occupied by the Dominion Atlantic Railway Steamship Co., the United Fruit Co. and the Red Star Towing & Wrecking Co. The loss amounted to about $50,000 on the storage sheds. Some vessels lying alongside were put out into the stream in time to avoid serious injury.

A corporation has been formed with Thomas W. Lawson as its president to combine a number of the schooner fleets engaged in the coasting trade.

Attractive low rates to points in the west and northwest by way of the Nickel Plate road. Sale of tickets at all stations begins Feb. 15 and will continue daily up to and including April 30, 1903. Get particulars of nearest agent. E. A. Akers, C. P. & T. A., Cleveland, O. 286, Mar. 1.

TRADE NOTES.

Wilson & Silsby, Boston, Mass., sail makers, have sensitized a piece of duck and printed a photograph of the Quissetta upon it. It does service as a calendar. Surely this is appropriate for makers of sails.

In a letter discussing general business conditions, Mr. Wm. Haines of the Wm. S. Haines Co., Philadelphia, says of the business of the company: "Last year there were sold over 100,000 of the Heintz steam traps, and at present we have a great deal of trouble to fill the orders that are coming to us. Our business has been far in excess of anything we had expected."

The St. Joseph & Elkhart Power Co. of Mishawaka, Ind., is installing a large hydraulic plant on the St. Joseph river near Mishawaka, including power house, dam and hydraulic and electric equipment for the generation and transmission of electric power to the cities of South Bend, Mishawaka and Elkhart and adjacent territory. The energy will be used for general lighting and power purposes. The consulting engineers and general contractors for the complete development are Messrs. Sanderson & Porter, 31 Nassau street, New York, who have recently purchased from the Westinghouse Electric & Manufacturing Co. four 1,000-K. W., 13,200-volt, revolving-field alternators, and two 125-K. W., direct-current exciters. The machines are all to be direct-coupled to horizontal shaft water wheels. The engineers have also recently ordered a complete high-tension large-capacity switchboard from the Westinghouse company, including a complete equipment of the latest type of electrically-operated Westinghouse oil-brake switches for operation at 13,200 volts.

The Ohio Brass Co. has decided to substitute alternating current power distribution for the direct-current system at present in use in its shops at Mansfield, O., on account of the superior economy of the former. A recent purchase from the Westinghouse Electric & Mfg. Co. comprises a 180-kilowatt, 7,200-alternation, two-phase alternator, a direct-current exciter, switchboard equipment and the following induction motors; Two of 40 H. P., four of 30 H. P. one of 20 H. P., one of 15 H P. and one of 2 H. P. This apparatus is to provide increased capacity and to replace the following direct-current machinery: One 75-kilowatt, 125-volt generator, one 35-kilowatt generator, three 40-H. P. motors, two 25-H. P. motors, and two 5-H. P. motors; also a three-panel, direct-current switchboard. This action has been taken after a careful and thorough examination into the relative merits of direct current and alternating current motors for power distribution in this company's factory. The alternating-current motors have been chosen on account of their low cost of maintenance and freedom from breakdown.

A pleasing feature of the recent gathering in Chicago of representatives of the Chicago Pneumatic Tool Co. from all over the United States and Canada, was the banquet given by President J. W. Duntley at the Union League club. The banquet followed the first day's session and was planned with a view to having the representatives become well acquainted with each other. Mr. J. W. Duntley was taken by surprise when presented with a beautiful loving cup. Then a gold match safe set with diamonds was given to Vice-President W. O. Duntley, Mr. Booth making the presentation speech. General good feeling followed responses from these two principals of the company. Everybody told of his experience in dealing with affairs of the organization during the past year. Judge Steer, who favored the party with his presence later in the evening, made the closing address, in which he touched on the success of the Messrs. Duntley in bringing the Chicago Pneumatic Tool Co. up from a business in which they constituted the entire working force, to the prominent place it now occupies in the commercial world. The meeting of the representatives was continued on the 13th and 14th. The exhibit rooms of the company were visited where demonstrations were made of new tools which are being brought out, and where improvements that have been made in various machines were thoroughly gone over. A business increase of 50 per cent. is looked for in the year just opening.

Mr. Lewis, a member of the New York state senate, a few days ago introduced in that body a resolution calling upon the New York state representatives in congress to request a full survey of the New York canals with a view to having the government purchase them and provide ship-canal communication between the lakes and tidewater. Of course the idea of turning the New York canals over to the general government is not new. The resolution is in some quarters regarded as a measure intended to side-track the 1,000-ton barge canal improvement. The preamble lays special stress upon the report of the engineering commission that recently made surveys and collected other valuable data on the subject of deep-water communication between the lakes and the seaboard. It is claimed that the report of this commission is proof of feasibility of the project and that the estimated cost is within reason, in view of the present day undertakings of an engineering kind.

The Toledo Boiler Works, Locust and Water streets, Toledo, is a new concern that is to make a specialty of marine work. They are thoroughly equipped for making and repairing boilers of every description and for all kinds of sheet iron work. Marine work will not be new to them, as Mr. Robert Wildman, vice-president and general manager, was at the head of the firm of Wildman Bros. of Bay City for over twenty-five years.

Mr. W. O. Duntley, vice-president of the Chicago Pneumatic Tool Co. is making a tour of the Pacific coast in the interest of his company.

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will not blow out, will hold against any steam pressure, will stand highest temperature.

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The most reliable flat packing on the market for all conditions of steam service

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For high speed, high temperature, high pressure, with or without wire interwoven.

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FOR SHIPS AND FORTIFICATIONS.
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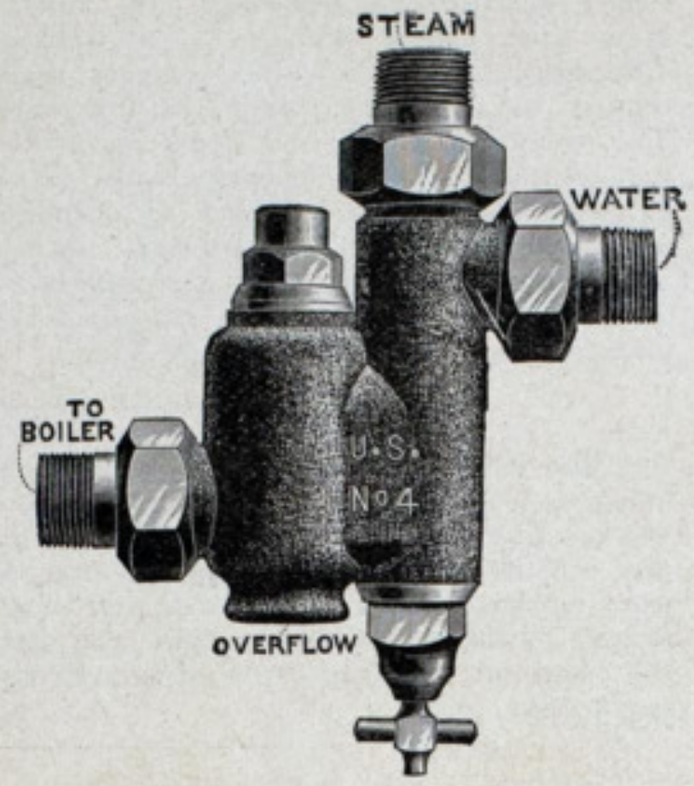
100 William St., New York, U. S. A.

AMERICAN INJECTOR CO., DETROIT, MICH.

A striking lithographic cover adorns the catalogue issued by the American Injector Co. of Detroit, Mich. It represents Uncle Sam standing on one side of the Atlantic with a United States automatic injector in his hand shooting across at a lot of figures on the other side representing England, Germany, France, Russia and the orient. The American Injector Co. are the sole owners and manufacturers of the United States automatic and world (double tube) injectors. They are also manufacturers of jet pumps, drive well jet pumps, exhaust injectors, fire plugs, grease cups and brass oil cups and all kinds of jet work for steam, water, oils, acids and chemicals. The catalogue is printed in two colors, the titles in red and the body in black and it is abundantly illustrated with very careful drawings. The catalogue is also a price list so that it is altogether a very complete document. Concerning the making of repairs, always a very vital consideration, the catalogue says:



"Owing to the construction of the United States automatic injector it is a very simple matter to replace parts should they become worn. No special tools are required. Hence it is never necessary to send a U. S. injector to the factory for repairs."

For the convenience of manufacturers of traction, portable and threshing engines a special tvpe of connections for injectors are made, all of which are copiously illustrated. To meet the demand for injectors to work without a lift at a very low pressure of steam the company makes a special low-pressure, non-lifting United States injector which will start with from 1 to 5 lbs. of steam. Automobile injectors are also made for manufacturers and builders of automobiles. They are specially tested for very high or very low steam. Express directions are given in the catalogue as to how to connect the injectors. Comprehensive descriptions are also given of the World injectors, the Trix exhaust injector, the American injector, American jet pumps and the various specialties which the company makes. Anyone interested is invited to ask for the catalogue.

TEMPESTUOUS TRIP OF THE MINNETONKA.

The Boston Herald thus speaks of the arrival in Boston of the lake-built steamer Minnetonka after her tempestuous voyage:

"With the arrival at quarantine of the American lake-built steamer Minnetonka, there terminated the worst voyage that ever fell to the lot of her officers and crew. That the vessel survived the terrible ordeal was due entirely to her staunchness and seaworthy quality. Leaving Newport, Eng., Nov. 30, laden with 6,240 tons of bituminous coal for the Metropolitan Coal Co., the vessel encountered tempestuous weather from the very outset, and her course was beset by continuous gales and rough head seas. Early in the voyage the boilers were found to be defective, and, on Dec. 11, she was rendered totally disabled, when on the eastern edge of the Grand banks, about 850 miles from Halifax. A tremendous sea struck the craft a staggering blow, which nearly wrecked her. The majority of the crew thought she was doomed and they gave up hope of ever reaching port. But gradually she shook off the great mass of water and righted herself. When the steam steering gear was carried away, an attempt was made to utilize the hand steering gear, but before it could be put in condition for use the iron work was twisted and carried overboard by the seas. In this emergency a hawser was rigged to the windlass and the vessel was steered from the forecastle by means of bell signals, for ten days, during which time she covered 1,600 miles and entered the harbor of St. George, Bermuda. Before reaching there her supply of bunker coal gave out and she was obliged to burn 100 tons of her cargo."

The stern paddle car transport steamer Lagunitas, the first of her kind in the country, is to be launched from the yard of W. A. Boole & Son, San Francisco, in a few days. She is for the North Shore Railroad and will be used in transporting cars and freight between Sausalito and San Francisco. The Lagunitas is 285 ft. long.

Steamer Wanted.

Wanted to buy a light draught, stern wheel steamer, about 70 ft. hull, for freight and passenger service. Give full description, price and terms f. o. b. cars. Address Box 39, Marine Review Pub. Co., 39-41 Wade Bldg., Cleveland, O.

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The "Messageries Maritimes" Company	87,600 "
Chemins de fer de l'Ouest: (The French Western Railway Co.) Steamships plying between Dieppe and Newhaven	18,500 "
Total Horse Power of Boilers in Use	1,501,520

WORKS: Ateliers et Chantiers de l'Ermitage, at Saint-Denis (Seine), France.

TELEGRAPHIC ADDRESS: Belleville, Saint-Denis-Sur-Seine.

LUXURY ABOARD A WARSHIP.

An attache of the bureau of equipment in Washington lately made the following statement:

"The outfits for our warships are becoming more handsome and sumptuous every year. A stranger stepping into the ward-room of one of our cruisers would never imagine that he was on a ship, except for the somewhat cramped quarters. The expensive rugs, heavy mahogany furniture and costly fittings resemble the interior of a modern and expensive hotel rather than that of a fighting machine. When the American navy officer puts to sea nowadays he is provided with every luxury that a modern hotel can furnish."

An examination of the "allowance list" for the new battleship Maine, which is soon to go into commission, bears out what the officer above quoted said about the life of ease and luxury which our officers lead while at sea. For instance, it is estimated that it will cost $5,000 alone to purchase the dining table outfits for the officers of the battleship. This does not include any solid silver, although everything will be of the finest. The fact that the Maine is to be a flagship will require five separate messes to be maintained, so provision must be made for that many tables. The flag officer, of course, is fitted out in the most liberal manner; then comes the captain's table, the ward-room mess, the junior officers' mess and the mess for the warrant officers. The furnishings for the flag officer's table are bought with a liberal hand, and he has every accessory that would be needed for the most elaborate dinner entertainment. For instance, the Maine will go into commission with the following stock of supplies in the flag officer's quarters: Thirty-six doilies, thirty-six napkins of two different sizes, the same number of table cloths and towels for glasses. The same outfit is provided for the captain's mess, for the wardroom mess, the junior officers' mess and the warrant officers' mess, although the last two messes' supply is cut down to one style of table cloths and napkins. A long list of cooking and pantry utensils, covering four printed pages, single column, of the book of "allowances" seemingly calls for everything that would be needed to stock a large-sized hotel. One of these outfits is provided for each of the five messes. In addition, supplies of the same kind are to be bought for the mess of the masters-at-arms, the mess of the ship's cooks, for the berth deck mess and the bake oven and general mess.

The outfit of plated ware for the flag officer is generous in the extreme, and, with the china and glassware equipment, furnishes every kind of dish or table utensil that would be required at any kind of dinner function. There is a gradual shading off in the number and variety of these articles when it comes to supplying the messes below the grade of captain. The glassware stock for the flag officer includes half a dozen decanters of different kinds and styles, two dozen champagne glasses, twice that number of claret glasses, two dozen liquor glasses and two dozen sherry glasses. The captain's mess gets along with only eighteen glasses for each kind of wine; while the warrant officers are not supposed to indulge in such extravagances, as they get none at all.

It is not generally known that every commissioned warship in our navy has on board a complete athletic outfit, so that if officers contract gout or other complaints that follow high living they may regain health by vigorous exercise. The Maine, for instance, will get the following athletic goods: Punching bags, Indian clubs of three sizes, the same number of dumbbells of varying weights, eight pairs of eight-ounce boxing gloves, and all kinds of fencing supplies, such as gloves, helmets and plastrons. Theodore Roosevelt, by the way was responsible for the introduction of the athletic outfit on our warships. When assistant secretary of the navy he caused an order to be issued calling for boxing gloves, dumbbells and other strength-giving apparatus to be supplied to each vessel.

At the annual meeting of the stockholders of the Standard Chain Co., to be held in the Frick building, Pittsburg, on Tuesday Feb. 17, action will be taken on a proposition to reduce the capital. It is stated that the assent of about 90 per cent. of the stockholders has been given to the proposed change. It is suggested by the directors that the capital stock be decreased from $3,000,000 to $1,500,000. The proposition provides that holders of the present preferred stock are to receive one share of common stock for each share of preferred stock held by them, and the holders of four shares of common stock are to receive one share of the new common stock in exchange. It is expected that under the proposed arrangements the directors will be able to pay quarterly dividends, beginning this year.

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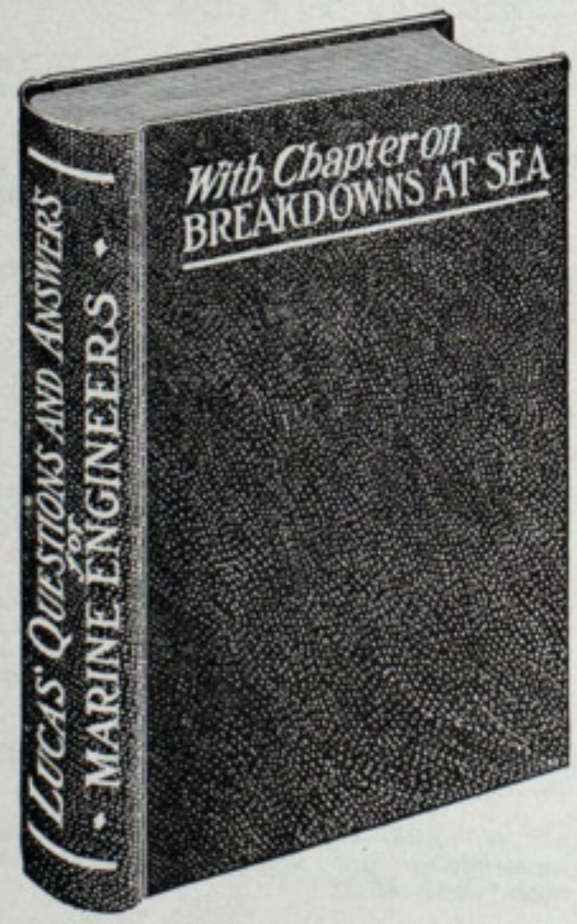

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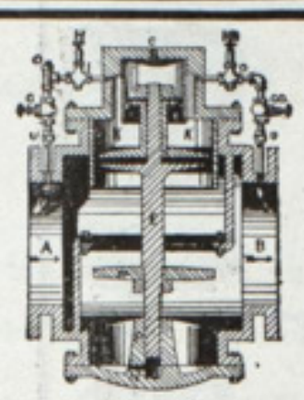

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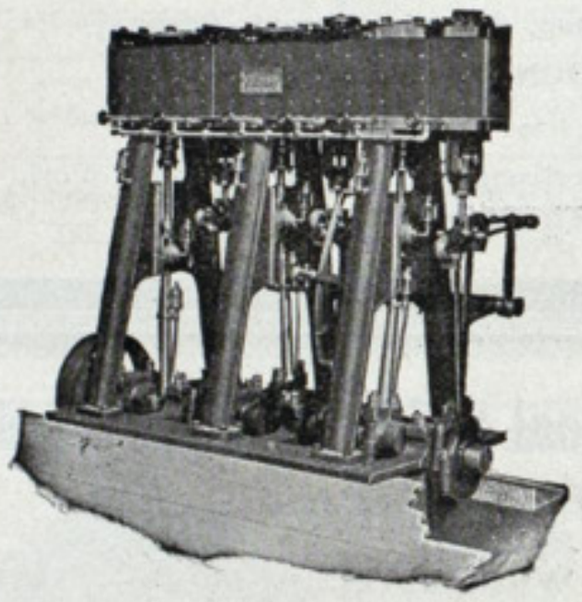

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U. S. Engineer Office, Grand Rapids, Mich., Jan. 20, 1903. Sealed proposals for repair of piers at St. Joseph and Black Lake, Mich., will be received here until 3 p. m., Feb. 19, 1903, and then publicly opened. Information furnished on application. CHARLES KELLER, Capt., Engrs. Feb. 12.

U. S. Engineer Office, Duluth, Minn., Jan. 19, 1903. Sealed proposals for pier work and dredging at Port Wing, Wis., will be received here until noon, Feb. 19, 1903, and then publicly opened. Information on application. D. D. GAILLARD, Capt., Engrs. Feb. 12.

U. S. Engineer Office, Duluth, Minn., Jan. 24, 1903. Sealed proposals for furnishing and placing about 26,000 tons of riprap at Ashland, Wis., will be received here until noon, Feb. 24, 1903, and then publicly opened. Information on application. D. D. GAILLARD, Capt., Engrs Feb. 19

U. S. Engineer Office, Grand Rapids, Mich., Jan. 6, 1903. Sealed proposals for repairs of piers and closing entrance to outer basin at Michigan City, Ind., and for repairs of north pier at Grand Haven, Mich., will be received here until 3 p. m., February 5, 1903, and then publicly opened. Information furnished on application. Charles Keller, Capt. Engineers. Jan. 29.

U. S. Engineer Office, 1637 Indiana Ave., Chicago, Ill., Jan, 8, 1903. Sealed proposals for dredging in Calumet River, Ill., will be received here until 12 noon, February 10, 1903, and then publicly opened. Information on application. O. H. ERNST, Lieut.-Col. Engineers. Feb. 5.

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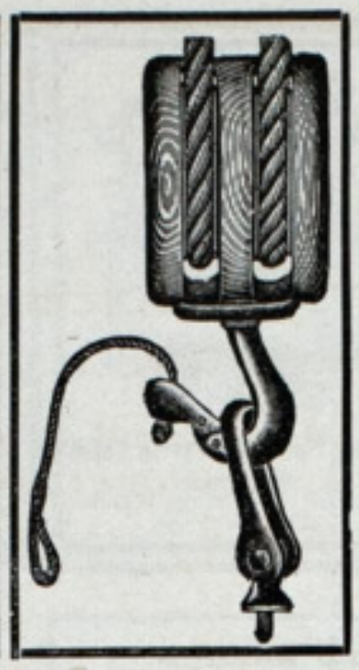

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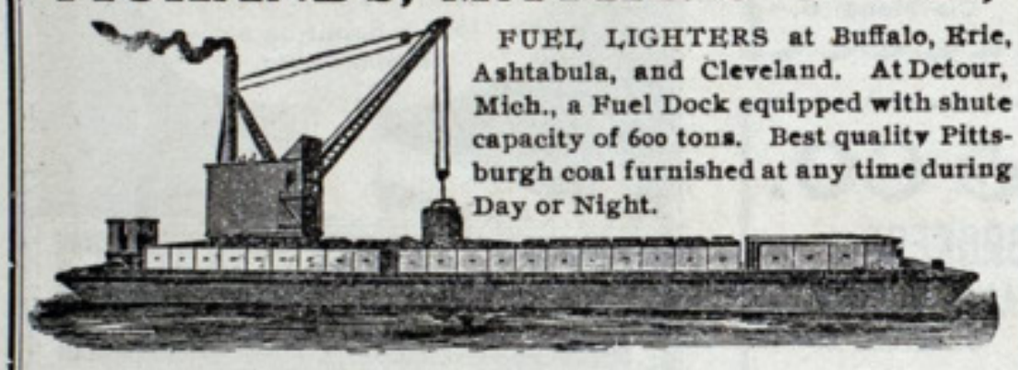

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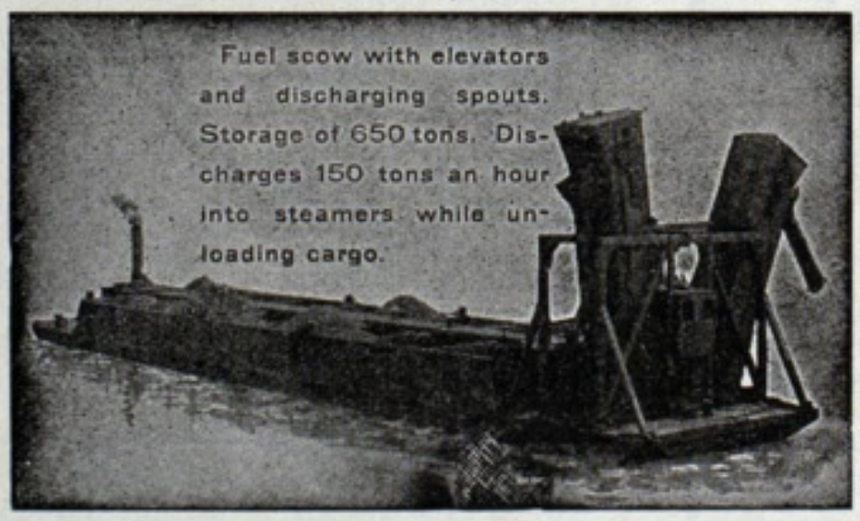

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HYDRAULIC MACHINERY.

Watson-Stillman Co., The.....New York.
Wood & Co., R. D. .....Philadelphia.

ICE MACHINERY.

American Linde Refrigerating Co. .....New York.
Roelker, H. B. .....New York.

INDICATORS FOR STEAM ENGINES.

American Steam Gauge Co. .....Boston.
Ashton Valve Co. .....Boston.

INJECTORS.

American Injector Co. .....Detroit
Crane Co. .....Chicago.
Jenkins Bros. .....New York.
Lunkenheimer Co. .....Cincinnati.
Penberthy Injector Co. .....Detroit, Mich.

INSURANCE, MARINE.

Brown & Co. .....Buffalo.
Brown, W. W. .....Cleveland.
Dunham, R. J. .....Chicago.
Elphicke, C. W. & Co. .....Chicago.
Hawgood & Co., W. A. .....Cleveland.
Helm & Co., D. T. .....Duluth
Hutchinson & Co. .....Cleveland.
Insurance Co. of North America....Philadelphia
McCarthy, T. R. .....Montreal.
McCurdy, Geo. L. .....Chicago.
Mitchell & Co. .....Cleveland.
Peck, Chas. E. & W. F. ...New York and Chicago.
Richardson, W. C. .....Cleveland.
Sullivan, D. & Co. .....Chicago.
Weeks, F. H. .....New York.

IRON ORE AND PIG IRON.

Bourne-Fuller Co. .....Cleveland.
Hanna, M. A. & Co. .....Cleveland.
Pickands, Mather & Co. .....Cleveland.

LAUNCHES—STEAM, NAPHTHA, ELECTRIC.

Marine Construction & D. D. Co.....
.....Mariner's Harbor, S. I., N. Y.
Warrington Iron Works .....Chicago.
Willard, Chas. P. .....Chicago.

LIFE PRESERVERS, LIFE BOATS, BUOYS.

Armstrong Cork Co. .....Pittsburg.
Drein, Thos. & Son .....Wilmington, Del.
Kahnweiler's Sons, D. .....New York.
Lane & DeGroot .....Long Island City, N. Y.
Marine Construction & D. D. Co, Mariner's Harbor,.....S. I. N. Y.

LIGHTS, SIDE AND SIGNAL.

Helvig, H. A. J.....New York.
Russell & Watson .....Buffalo.

LOGS.

Walker & Sons, Thomas .....Birmingham, Eng.
Nicholson Ship Log Co. .....Cleveland.
Also Ship Chandlers.

MACHINISTS.

Chase Machine Co.....Cleveland.
Macbeth Iron Co. .....Cleveland.
Union Machine & Boiler Co.....Cleveland.
Ward Machine Co.....Cleveland.

MACHINE TOOLS (WOOD WORKING).

Atlantic Works, Inc. .....Philadelphia.

MACHINERY, NEW AND SECOND HAND.

Bowler & Co. Geo. H. .....Cleveland.
Clyde Machine Works.....Chicago.

MAN-HOLES, SWING DOORS, ETC.

"Long-Arm" System Co. .....Cleveland.

MARINE RAILWAYS, BUILDERS OF

Crandall & Son, H. I. .....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.

Fogg, M. W.....New York.

MECHANICAL DRAFT FOR BOILERS.

American Ship Building Co. .....Cleveland
Bloomsburg & Co., H. .....Baltimore, Md.
Buffalo Forge Co. .....Buffalo.
Detroit Ship Building Co. .....Detroit
Steam Boiler Equipment Co. .....New York.
Sturtevant, B. F. Co. .....Boston.

METALLIC PACKING.

Allen, Joseph .....Collingswood, N. J.
Hayden Mfg. Co., N L. .....Columbus, O.
Katzenstein, L. & Co. .....New York.
U. S. Metallic Packing Co. .....Philadelphia.

METAL POLISH.

Bertram's Oil Polish Co. .....Boston.

MOTORS, GENERATORS—ELECTRIC.

Buffalo Forge Co. .....Buffalo.
Electro-Dynamic Co. .....Philadelphia.
Elwell-Parker Electric Co. .....Cleveland.
General Electric Co. .....Schenectady, N. Y.
"Long-Arm" System Co. .....Cleveland.
Seidler-Miner Electric Co. .....Detroit.
Sturtevant, B. F. Co. .....Boston.
United Marine Mfg. & Supply Co.....New York.
Westinghouse Electric & Mfg. Co....Pittsburg, Pa.

NAUTICAL INSTRUMENTS.

Bliss, John & Co. .....New York.
Ritchie, E. S. & Sons .....Brookline, Mass.

NAVAL ARCHITECTS.

Gaskin, Edward .....Buffalo.
Goodenough, Walter .....New York.
Kidd, Joseph .....Duluth, Minn.
Logan, Robert .....Cleveland.
Mosher, Chas. D. .....New York.
Newman, R. L. .....New York.
Sadler, Perkins & Field.....New York
See, Horace.....New York.
Wood, W. J. .....Chicago.

OAKUM.

DeGrauw, Aymar & Co. .....New York.
Stratford Oakum Co.,.....Jersey City, N. J.

OILS AND LUBRICANTS.

Dixon Crucible Co., Joseph .....Jersey City, N. J.
Standard Oil Co. .....Cleveland.

OIL FILTERS.

Haines Co., W. S. .....Philadelphia.

PACKING.

Allen, Joseph .....Collingswood, N. J.
Crane Co. .....Chicago.
Hayden Mfg. Co., N. L. .....Columbus, O.
Jenkins Bros. .....New York.
Katzenstein, L. & Co. .....New York.
United States Metallic Packing Co. ....Philadelphia.

PAINTS.

Baker, Howard H. & Co .....Buffalo.
Berry Bros., Ltd. .....Detroit.
Day's Varnish & Dryer Co. .....Cleveland.
Mohawk Paint & Chemical Co. .....New York.
New Jersey Zinc Co. .....New York.
Topky Brothers .....Ashtabula, O.
Upson-Walton Co. .....Cleveland.

PATENT ATTORNEYS.

Thurston & Bates .....Cleveland.

PATTERN SHOP MACHINERY.

Atlantic Works, Inc. .....Philadelphia.

PIPE—BRASS AND COPPER, IRON PIPE SIZE.

Waterbury Brass Co.....New York.

PIPE, WROUGHT IRON.

Bourne-Fuller Co .....Cleveland.
Crane Co .....Chicago.
Macbeth Iron Co.....Cleveland.

PLANING MILL MACHINERY.

Atlantic Works, Inc. .....Philadelphia.

PLATE BENDING AND PLANING MACHINES.

Wood & Co., R. D. .....Philadelphia.

PLUMBING, MARINE.

Mott, J. L., Iron Works .....New York.
Reilly Repair & Supply Co., James....New York.
Sands, Alfred B. & Son .....New York.

PNEUMATIC TOOLS.

Allen, John F., ... New York.
Chicago Pneumatic Tool Co. .....Chicago.
Q. & C. Co. .....Chicago.

POLISH FOR METALS.

Bertram's Oil Polish Co.....Boston.

POWER DOORS AND HATCHES.

"Long-Arm" System Co. .....Cleveland.

PRESSURE REGULATORS.

Kieley & Mueller .....New York
Ross Valve Co. .....Troy, N. Y.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

PROPELLER WHEELS.

American Ship Building Co. .....Cleveland
Atlantic Works .....East Boston, Mass.
Baltimore Ship Building & Dry Dock Co. Baltimore.
Bath Iron Works, Ltd. .....Bath, Me.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Ship Building Co. .....Detroit.
Fore River Ship & Engine Co. .....Quincy, Mass.
Great Lakes Engineering Works.....Detroit.
Hyde Windlass Co. .....Bath, Me.
Harlan & Hollingsworth Co.....Wilmington, Del.
Jenks Ship Building Co. .....Port Huron, Mich.
Lockwood Mfg. Co. .....East Boston, Mass.
Macbeth Iron Co..... Cleveland.
MacKinnon Mfg. Co. .....Bay City, Mich.
Maryland Steel Co. .....Sparrow's Point, Md.
Milwaukee Dry Dock Co. .....Milwaukee.
Moran Bros. Co. .....Seattle, Wash.
Neafie & Levy Ship & Engine Bldg. Co.....Phila.
Newport News Ship Bldg. Co...Newport News, Va.
Nixon, Lewis .....Elizabeth, N. J.
Phosphor Bronze Smelting Co., Ltd...Philadelphia.
Pusey & Jones Co. .....Wilmington, Del.
Risdon Iron Works .....San Francisco.
Roelker, H. B. .....New York.
Sheriffs Mfg. Co. .....Milwaukee.
Superior Ship Building Co.....Superior, Wis.
Thropp & Sons Co., J. E. .....Trenton, N. J.
Trigg, Wm. R. Co. .....Richmond, Va.
Trout, H. G. .....Buffalo.

PROJECTORS, ELECTRIC.

Elwell-Parker Electric Co. .....Cleveland.
General Electric Co. .....Schenectady, N. Y.
Seidler-Miner Electric Co. .....Detroit.
Westinghouse Electric & Mfg. Co....Pittsburg, Pa

PUMPS FOR VARIOUS PURPOSES.

Blake, Geo. F. Mfg. Co. .....New York.
Clyde Machine Works..... .....Chicago.
Great Lakes Engineering Works.....Detroit.
Kingsford Foundry & Machine Wks. Oswego, N. Y.

PUNCHES, RIVETERS, SHEARS.

Chicago Pneumatic Tool Co. .....Chicago.

REFRIGERATING APPARATUS.

Roelker, H. B. .....New York.

REGISTER FOR CLASSIFICATION OF VESSELS.

Great Lakes Register .....Cleveland.
Record of American & Foreign Shipping.New York.

RELEASING HOOKS FOR DETACHING BOATS.

Standard Automatic Releasing Hook Co. New York.

RIVETS, STEEL, FOR SHIPS AND BOILERS.

Bourne-Fuller Co. .....Cleveland.

RANGES.

Russell & Watson .....Buffalo.

RIVETS—BRASS AND COPPER.

Waterbury Brass Co.....New York.

RUBBER INSULATED WIRES.

Roebling's Sons, Jno. A...New York and Cleveland.

SAFETY VALVES.

American Steam Gauge Co. .....Boston.
Ashton Valve Co.....Boston.
Hayden Mfg. Co., N. L..... Columbus, O.
Lunkenheimer Co. .....Cincinnati.

SAIL MAKERS.

Baker, Howard H. & Co. .....Buffalo.
Upson-Walton Co. .....Cleveland.
Wilson & Silsby .....Boston.

SALVAGE COMPANIES.

See Wrecking Companies.

SCHOOLS—NAUTICAL, ENGINEERING.

Buffalo Com. & Electro-Mechanical Inst...Buffalo.
Chicago Nautical School .....Chicago.

SEARCH LIGHTS.

Elwell-Parker Electric Co. .....Cleveland.
General Electric Co. .....Schenectady, N. Y.
Seidler-Miner Electric Co. .....Detroit.
Westinghouse Electric & Mfg. Co....Pittsburg, Pa.

SHEARS.

See Punches, Rivets, and Shears.

SHIP AND BOILER PLATES AND SHAPES.

Bourne-Fuller Co. .....Cleveland.

SHIP BUILDERS.

American Ship Building Co. .....Cleveland.
Atlantic Works .....East Boston, Mass.
Baltimore Ship Building & Dry Dock Co..Baltimore.
Bath Iron Works, Ltd.....Bath, Me.
Bell Engineering Works, David .....Buffalo.
Buffalo Dry Dock Co. .....Buffalo.
Cramp, Wm. & Sons.....Philadelphia.
Craig Ship Building Co. .....Toledo, O.
Chicago Ship Building Co.....Chicago.
Detroit Ship Building Co. .....Detroit.
Fore River Ship & Engine Co. .....Quincy, Mass.
Great Lakes Engineering Works.....Detroit.
Harlan & Hollingsworth Co. .....Wilmington, Del.
Jenks Ship Building Co. .....Port Huron, Mich.
Lockwood Mfg. Co.....East Boston, Mass.
Manitowoc Dry Dock Co.....Manitowoc, Wis.
Marine Construction & Dry Dock Co.....
.....Mariner's Harbor, S. I., N. Y.
Maryland Steel Co .....Sparrow's Point, Md.
Milwaukee Dry Dock Co.....Milwaukee.
Moran Bros. Co. .....Seattle, Wash.
Neafie & Levy Ship & Engine Bldg. Co.....Phila.
Newport News Ship Bldg. Co....Newport News, Va.
Nixon, Lewis .....Elizabeth, N. J.
Pusey & Jones Co. .....Wilmington, Del.
Risdon Iron Works .....San Francisco.
Roach's Ship Yard .....Chester, Pa.
Smith & Son, Abram .....Algonac, Mich.
Superior Ship Building Co.....Superior, Wis.
Trigg, Wm. R. Co. .....Richmond, Va.
Warrington Iron Works .....Chicago.
Willard, Chas. P. & Co. .....Chicago.

SHIP CHANDLERS.

Baker, Howard H. & Co. .....Buffalo.
Moran Bros. Co. .....Seattle, Wash.
Reilly Repair & Supply Co., James....New York.
Upson-Walton Co. .....Cleveland.

SHIP LANTERNS AND LAMPS.

Helvig, H. A. J.....New York.
Page Bros. & Co.....New York.
Russell & Watson.....Buffalo.

SMOOTH-ON COMPOUND, FOR REPAIRS.

Smooth-On Mfg. Co. .....Jersey City, N. J.

SPARS—LARGE SIZES.

Moran Bros. Co.....Seattle, Wash.

STAYBOLTS, IRON OR STEEL, HOLLOW, OR SOLID.

Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

STEAM VESSELS FOR SALE.

Elwell, Jas. W. & Co.....New York.
Holmes, Samuel.....New York.
King, Rufus S.....New York.
McCarthy, T. R.....Montreal, Can.
Newman, R. L.....New York.
Weeks, F. H.....New York.

STEAMSHIP LINES, PASS. AND FREIGHT.

American Line.....New York.
International Nav. Co.....Philadelphia.
Pere Marquette R. R. & S. S. Line.....Milwaukee.
Red Star Line.....New York.

STEEL CASTINGS.

Seaboard Steel Casting Co.....Chester, Pa.
Macbeth Iron Co..... Cleveland.

STEERING APPARATUS.

American Ship Building Co.....Cleveland.
Chase Machine Co. .....Cleveland.
Dake Engine Co.....Grand Haven, Mich.
Detroit Shipbuilding Co.....Detroit.
Electro-Dynamic Co.....Philadelphia.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.
Queen City Engineering Co.....Buffalo.
Sheriff Mnfg. Co.....Milwaukee.

STOCKS, BONDS, SECURITIES.

Brown, W. W.....Cleveland.
Fahey & Co.....Cleveland.

SUBMARINE DIVING APPARATUS

Morse & Son, A. J.....Boston.
Schrader's Son, A.....New York.

SURVEYORS, MARINE.

Goodenough, Walter.....New York.
Gaskin, Edward.....Buffalo.
Newman, R. L.....New York.
See, Horace.....New York.
Wood, W. J.....Chicago.

TESTS OF MATERIAL.

Hunt, Robert W. & Co.....Chicago.
Pittsburg Testing Laboratory, Ltd.....Pittsburg.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.

Allen, John F. .....New York.
Chicago Pneumatic Tool Co.....Chicago.
Q. & C. Co.....Chicago.
Watson-Stillman Co.....New York.

TOOLS, WOOD WORKING.

Atlantic Works, Inc.....Philadelphia.

TOWING MACHINES.

American Ship Windlass Co.....Providence, R. I.
Chase Machine Co.....Cleveland.

TOWING COMPANIES.

Donnelly Salvage & Wrecking Co....Kingston, Ont.
Midland Towing & Wrecking Co., Ltd.Midland, Ont.
Sincennes-McNaughton Line, Ltd....Montreal, Can.

TRAPS, STEAM.

Haines Co., Wm. S.....Philadelphia.
Kieley & Mueller.....New York.

TRUCKS.

Boston & Lockport Block Co..... .....Boston.

TUBING, SEAMLESS.

Benedict & Burnham Mnfg. Co....Waterbury, Conn.
National Tube Co.....Pittsburg.
Waterbury Brass Co.....New York.

VALVES, STEAM SPECIALTIES, ETC.

American Steam Gauge Co. .....Boston.
Ashton Valve Co. .....Boston.
Crane Co. .....Chicago.
Farnan Brass Works .....Cleveland.
Hayden Mfg. Co., N. L. .....Columbus, O.
Jenkins Bros.....New York.
Kieley & Mueller.....New York.
Lunkenheimer Co.....Cincinnati.
Ross Valve Co. .....Troy, N. Y.

VALVES FOR WATER AND GAS.

Wood & Co., R. D.....Philadelphia.
Ross Valve Co. .....Troy, N. Y.

VARNISHES.

Berry Brothers, Ltd.....Detroit.
New Jersey Zinc Co.....New York.
Also Ship Chandlers.

VESSEL CASTINGS.

American Ship Building Co..... .....Cleveland.
Macbeth Iron Co..... .....Cleveland.

VESSEL AND FREIGHT AGENTS.

Boland, John J.....Buffalo.
Brown & Co.....Buffalo.
Brown, W. W.....Cleveland.
Dunham, R J..... .....Chicago.
Elwell, Jas. W. & Co.....New York.
Elphicke, C. W & Co.....Chicago.
Hall & Root.....Buffalo.
Helm & Co., D. T. .....Duluth
Hawgood & Co., W. A.....Cleveland.
Holmes, Samuel.....New York.
Hutchinson & Co.....Cleveland.
King, Rufus S.....New York.
McCarthy, T. R.....Montreal.
Newman, R. L.....New York.
Mitchell & Co.....Cleveland.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.
Weeks, F. H.....New York.

VENTILATING APPARATUS FOR SHIPS.

Buffalo Forge Co. .....Buffalo.
Sturtevant, B. F. Co.....Boston.

WIRE—BRASS AND COPPER.

Waterbury Brass Co.....New York.

WIRE ROPE AND WIRE ROPE FITTINGS.

Baker, H. H. & Co.....Buffalo.
DeGrauw, Aymar & Co. .....New York
Roebling's Sons John A....New York and Cleveland.
Upson-Walton Co.....Cleveland.

WHISTLES, STEAM.

American Steam Gauge Co. .....Boston.
Ashton Valve Co. .....Boston.
Farnan Brass Works .....Cleveland.
Lunkenheimer Co.....Cincinnati.

WHITE METAL—SHEETS, RODS AND WIRE.

Waterbury Brass Co.....New York.

WINDLASSES.

American Ship Windlass Co.....Providence, R. I.
American Ship Building Co. .....Cleveland
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.

WINCHES.

American Ship Windlass Co.....Providence, R. I.
Hyde Windlass Co.....Bath, Me.

WOOD WORKING MACHINERY.

Atlantic Works, Inc.....Philadelphia.

WRECKING AND SALVAGE COMPANIES.

Donnelly Salvage & Wrecking Co....Kingston, Ont.
Midland Towing & Wrecking Co., Ltd.Midland, Ont.

YACHT AND BOAT BUILDERS.

Bell Engineering Works, David .....Buffalo.
Drein, Thos. & Son.....Wilmington, Del.
Lane & DeGroot.....Long Island City, N. Y.
Marine Construction & Dry Dock Co. ...New York.
Truscott Boat Mfg. Co. .....St. Joseph, Mich.
Warrington Iron Works.....Chicago.
Willard, Chas. P. & Co.....Chicago.

YAWLS.

Drein, Thos. & Son.....Wilmington, Del.
Lane & DeGroot.....Long Island City, N. Y.

ALPHABETICAL INDEX OF ADVERTISERS IN THE MARINE REVIEW AND MARINE RECORD.

The star (*) indicates that the advertisement appears alternate weeks. For addresses see advertisements on pages noted.

*Allen, John F. 11
Allen, Joseph 3
Almy Water Tube Boiler Co.... 15
American Injector Co. 10
American Line 13
American Ship Building Co..... 1
American Ship Masters Ass'n... 6
American Ship Windlass Co..... 2
American Steam Gauge Co..... 1
Armstrong Cork Co..... 48
Ashton Valve Co..... 16
Atlantic Works 5
*Atlantic Works, Inc..... 11
Audel & Co., Theo..... 36

Babcock & Wilcox Co..... 15
Bacon, H. H..... 40
Baldt Anchor Line 9
Baltimore Ship Building & Dry Dock Co. 4
Baker, Howard H. & Co..... 48
Bartlett & Snow Co., C. O..... 2
Bath Iron Works, Ltd..... 1
Bell, David, Engineering Works.. 7
Benedict & Burnham Mfg. Co.. 16
Bertram's Oil Polish Co..... 1
Berry Brothers, Ltd..... 33
Blake, Geo. F., Mfg. Co..... 9
*Bliss, John & Co..... 13
*Bloomsburg & Co., H..... 9
Boland, J. J..... 40
*Boston & Lockport Block Co.... 48
Bourne-Fuller Co. 16
Bowers, L. M. & Co..... 9
Bowler & Co., Geo. H..... 41
*Boyer's, L. Sons 13
Brown, Harvey L. 40
Brown & Co. 40
Brown Hoisting Machinery Co., Inc. 2
Brown, W. W. 40
Buffalo Commercial & Electro-Mechanical Institute 9
Buffalo Dry Dock Co..... 46
Buffalo Forge Co..... 16

Castner, Curran & Bullitt..... 39
Chase Machine Co. 8
*Chelsea Clock Co..... 3
Chicago Nautical School 12
Chicago Pneumatic Tool Co..... 16
Chicago Ship Building Co..... 46
Cleveland City Forge & Iron Co.. 38
Cleveland Trust Co. 36
Coe, Almer 8
Continental Iron Works 2
Cory, Chas. & Son 12
*Craig Ship Building Co..... 13
Cramp, Wm. & Sons, S. & E. B. Co. 1
*Crandall & Son, H. I. 11
Crane Co. 4-11

Dake Engine Co. 12
Dearborn Drug & Chemical Wks. 13
Dearing Water-Tube Boiler Co.... 15
DeGrauw, Aymar & Co..... 9
Delauney, Belleville & Co..... 32
Delaware River Iron S. B. & E. Works. 5
Detroit Ship Building Co..... 1
Dixon Crucible Co., Joseph..... 12
Donnelly Salvage & Wrecking Co. 7
Drein, Thos. & Son..... 4
Dunham, R. J. 40

Electro-Dynamic Co 1
Elphicke, C. W. & Co..... 40
Elwell, Jas. W., & Co..... 40
Elwell-Parker Electric Co. 2

Fahey & Co. 37
Falls Hollow Staybolt Co..... 4
Farnan Brass Works 12
Federal Trust Co. 36
Fix's S., Sons 37
Fletcher, W. & A. Co..... 5
Fogg, M. W. 38
Fore River Ship & Engine Co.... 5

Garrett-Cromwell Engineering Co. 3
Gaskin, Edward 41
General Electric Co. 16
Gilchrist, Albert J. 40
Goodenough, Walter 41
Goulder, Holding & Masten..... 40
Graham Coal and Coke Co..... 38
Great Lakes Engineering Works. 34
Great Lakes Register 7

Haines Co., Wm. S. 37
Hall Bros. 8
Hall & Root 40
Hanna, M. A. & Co..... 38
Hardy, Wm. A. 14
Harlan & Hollingsworth Co., The. 5
Hawgood & Co., W. A..... 40
Hayden Mfg. Co., N. L..... 37
Helm & Co, D. T. 40
Helvig, H. A. J..... 4
Herriman, F. D. 10
Holmes, Samuel 40
Hoyt, Dustin & Kelley 41
Hunt, Robert W. & Co..... 41
Hutchinson & Co. 40
Hyde Windlass Co. 48

Insurance Co. of North America.. 7
International Navigation Co. 13

Jenkins Brothers 3-12
Jenks Ship Building Co..... 47
Johns-Manville Co., H. W..... 31

Kahnweiler's Sons, David..... 4
Katzenstein, L. & Co..... 3
Kidd, Joseph 40
Kieley & Mueller..... 3
Kingsford Foundry & Machine Works 13
King, Rufus S. 40
Kremer, C. E. 40

Lake Erie Boiler Works..... 14
Lane & DeGroot 4
*Learmonth, Robert 3
Lebanon Chain Works..... 10
Lidgerwood Mfg. Co. 6
Lockwood Mfg. Co. 4
Logan, Robert 41
"Long-Arm" System Co. 1
L. S. & M. S. Ry..... 45
Lunkenheimer Co. 12

McCarthy, T. R. 40
McCurdy, Geo. L. 7
McCutcheon, C. H. 10
McPherson, Clark, Campbell & Jarvis 40
Macbeth Iron Co. 48
MacDonald, Ray G. 40
MacKinnon Mfg. Co. 8
MacLean Hydraulic Signal Co 6
Manitowoc Dry Dock Co. 31
Marine Construction & Dry Dock Co. 4
*Marine Iron Co. 4
Martin-Barriss Co. 9
Maryland Steel Co. 5
Midland Towing & Wrecking Co., Ltd. 48
Milwaukee Dry Dock Co. 46
Mitchell & Co. 40
Mohawk Paint & Chemical Co... 7
*Moran Bros. Co. 47
Morse & Son, A. J..... 37
Mosher, Chas. D. 41
*Mott, J. L., Iron Works..... 13

National Tube Co. 14
Neafie & Levy Co. 5
Newman, R. L. 40
Newport News Ship Building & Dry Dock Co. 5
New Jersey Zinc Co. 7
Nicholson Ship Log Co..... 3
Nixon, Lewis 5
North River Iron Works 4

Peck, Chas. E. & W. F..... 7
Penberthy Injector Co 10
Pere Marquette R. R. & S. S. Line 47
Phosphor Bronze Smelting Co. Ltd. 14
Pickands, Mather & Co. 40
Pinney & Warner ..... -0
Pittsburg Coal Co. 39
Pittsburg Testing Laboratory, Ltd. 41
Pittsburg White Metal Co..... 33
Potter, J. D 3
Powell, Ambrose V. 40
Pusey & Jones Co. 5

Q. & C. Co. 33
Queen City Engineering Co. 12

Record of American & Foreign Shipping 6
Red Star Line 3
Richardson, W. C. 40
*Reilly Repair & Supply Co., Jas. 8
Risdon Iron Works 5
*Ritchie & Sons, E. S..... 13
Roach's Ship Yard 5
Roberts Water Tube Boiler Co.. 15
Rochester & Pittsburg Coal & Iron Co. 39
*Roebling's, John A. Sons Co... 48
Roelker, H. B. 5
Ross Valve Co. 37
Rudder Pub. Co 47
Russell & Watson 6

Sadler, Perkins & Field..... 41
Safety Car Heating & Lighting Co. 3
Sands, Alfred B. & Son..... 37
Scherzer Rolling Lift Bridge Co. 9
Schrader's Sons, A. 9
Schwencke, Kirk & Co. 41
Seaboard Steel Casting Co. 33
See, Horace 41
Seidler-Miner Electric Co. 6
Shaw, Warren, Cady & Oakes.... 40
Sheriffs Mfg. Co. 8
Shipowners Dry Dock Co. 16
Sincennes-McNaughton Line, Ltd. 1
Smith & Son, Abram..... 10
Smith, Stanley B. & Co..... 39
Smooth-On Mfg. Co. 8
Spencer, H. R. 40
Standard Chain Co. 4
*Standard Oil Co. 14
Standard Releasing Hook Co. .. 38
Steam Boiler Equipment Co..... 9
Stirling Co. 15
Stratford Oakum Co., Geo. 6
Sturtevant, B. F. Co. 48
Sullivan & Co. 40
Superior Ship Building Co..... 36

Taylor Water Tube Boiler Co... 15
Thropp, J. E. & Sons Co..... 37
Thurston & Bates 41
*Topky Bros. 12
Trigg Co., Wm. R. 5
Trout, H. G. 8
Truscott Boat Mfg. Co. 10

Union Machine & Boiler Co..... 8
United Marine Mfg. & Supply Co.. 31
Upson-Walton Co. 48
U. S. Metallic Packing Co..... 48

Walker, Thomas & Son..... 3
Ward Machine Co. 37
Warrington Iron Works 10
Waterbury Brass Co. 48
*Watson-Stillman Co. 47
Webster, Camp & Lane Co..... 2
Weeks, F. H. 40
Westinghouse Electric & Mfg. Co. 16
White, Johnson, McCaslin & Cannon 40
*Willard, Chas. P. & Co..... 13
Wood, W. J. 40

Youghiogheny & Lehigh Coal Co.. 39

Photographs of Marine Scenes on the Great Lakes.

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Unloading Ore from Whaleback, two views.
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Chicago River Elevators.
Lake Front, from Illinois Central Station.
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Cleveland Harbor from Lake View Park.
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Ellsworth Coal Chutes-Dumping Car, two views.
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Unloading Ore, two views.
Globe Iron Works Ship Yard.
Globe Iron Works Ship Yard, Laying Keel of No. 400.

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A Lumber Tow.

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General View of Locks from Offices.
Poe Lock, from below, closed.
Poe Lock, from below, open.
Poe Lock, from above.
Poe Lock, with Whaleback.
Weitzel Lock, from above.
Weitzel Lock, from below.
Str. North-Land Passing Locks, two views.
Upper Entrance to Lock Canal.
Gate Mechanism.
Interior of Power House.
Canadian Lock from Upper End.
Canadian Lock from Lower End.
The Rapids, looking up.
The Rapids, looking across.
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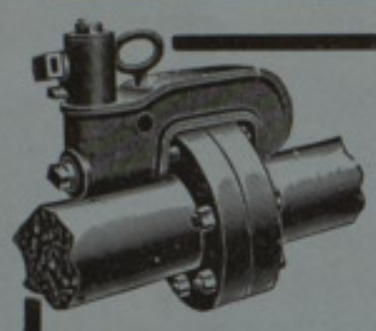

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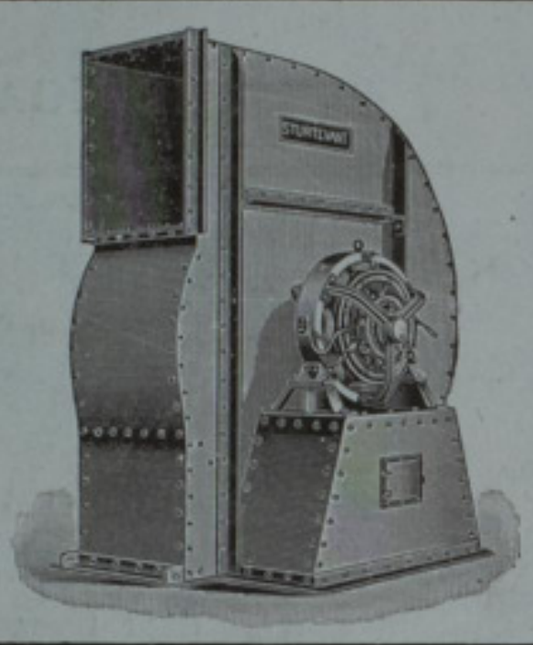

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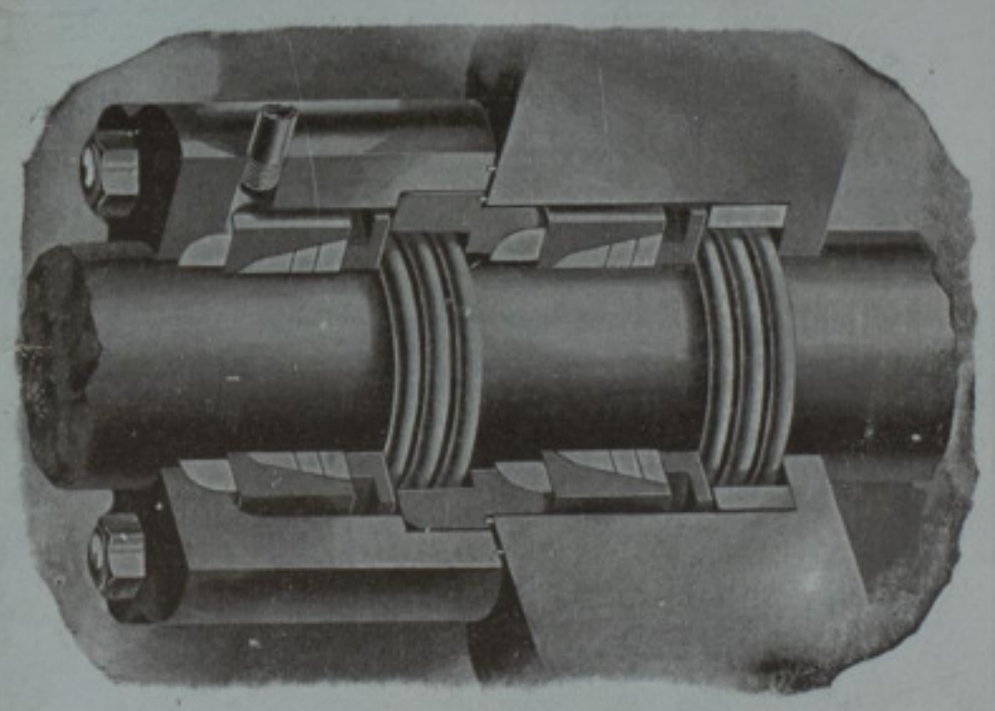

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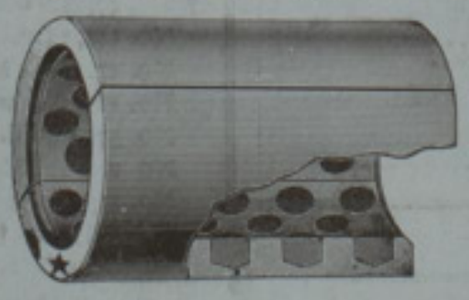

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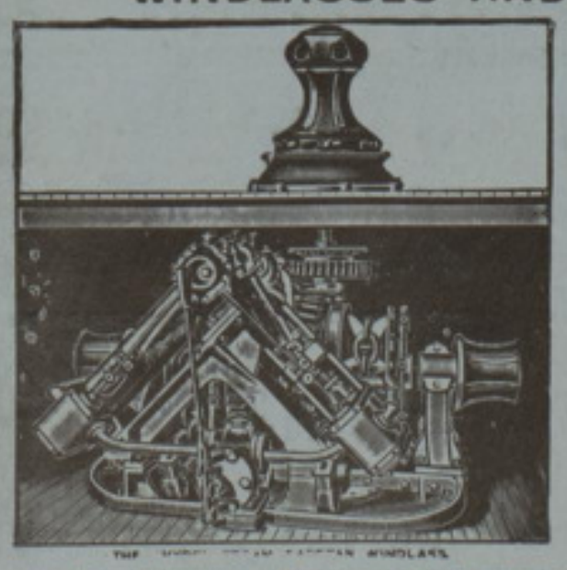

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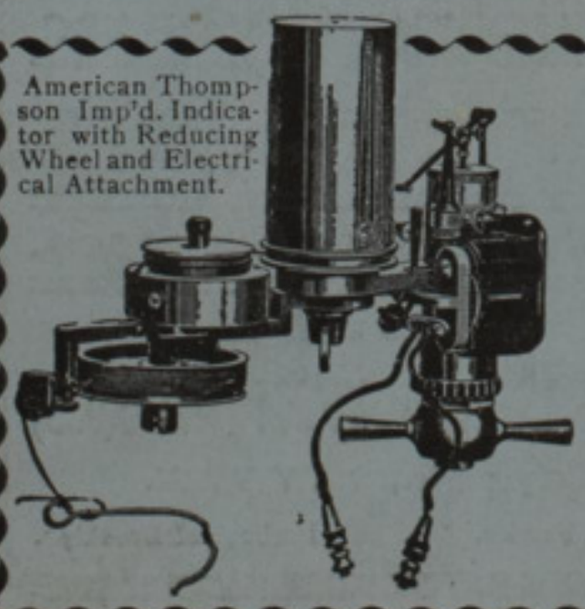

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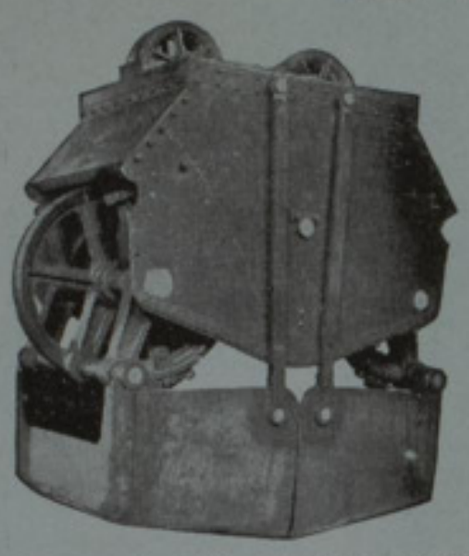

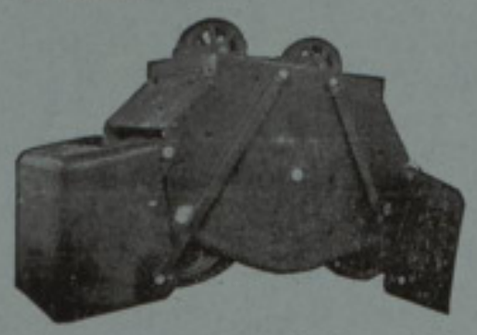

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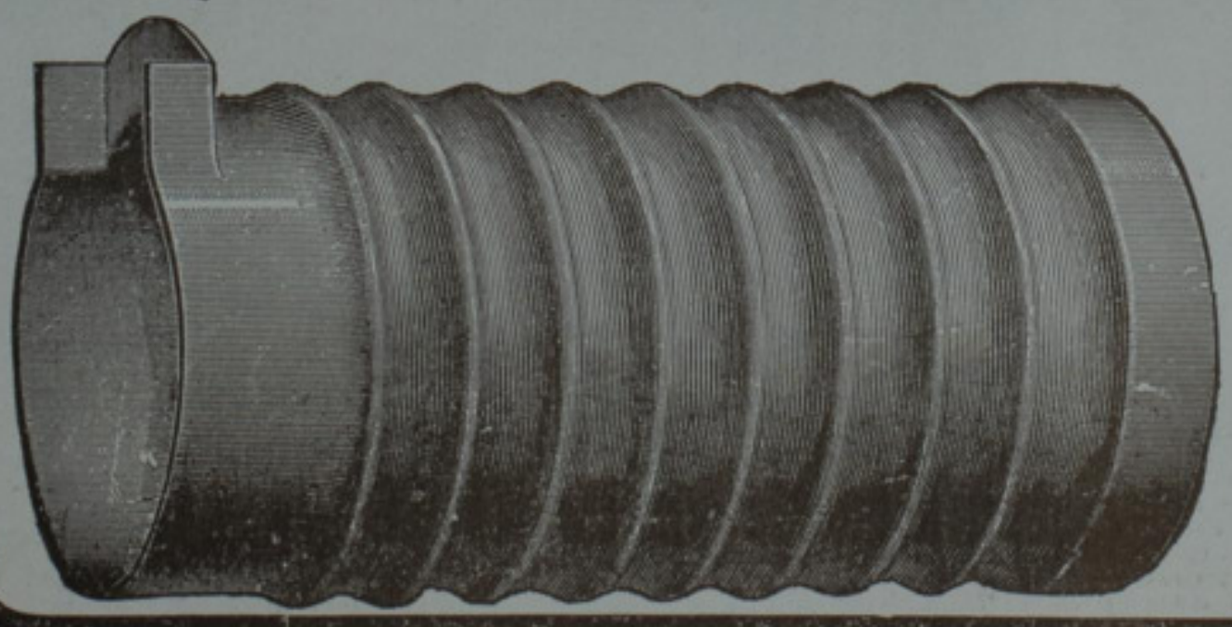

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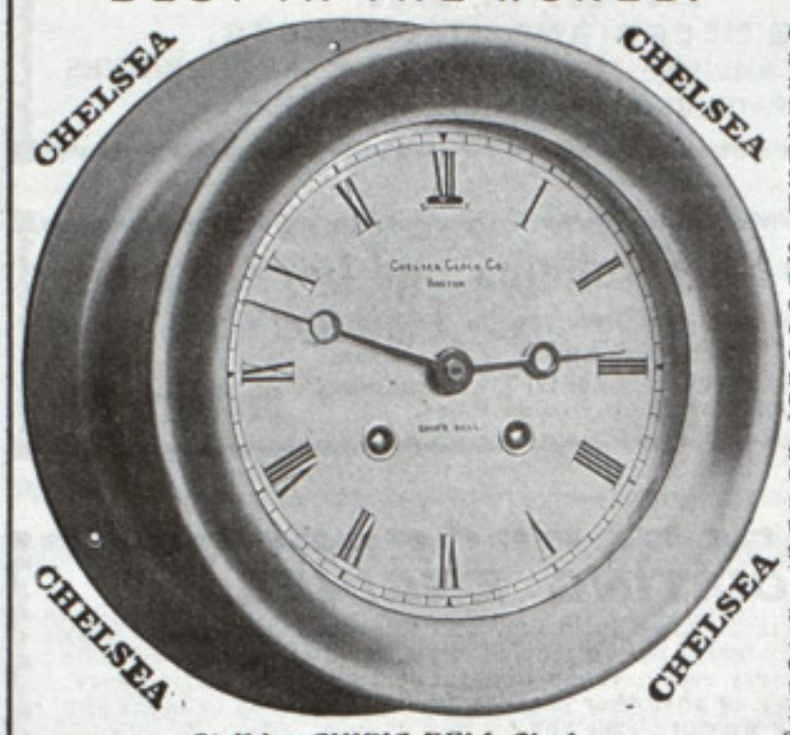

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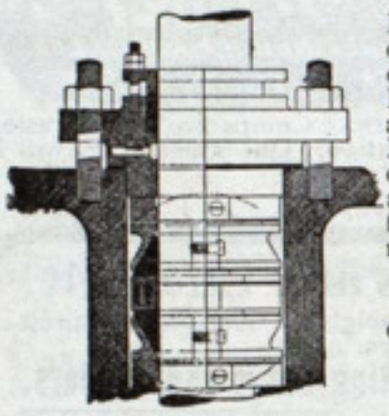

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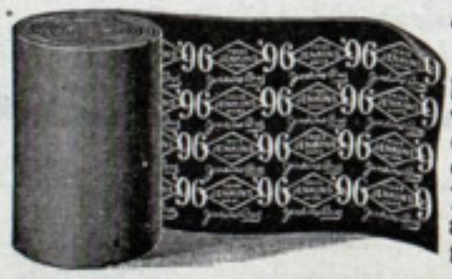

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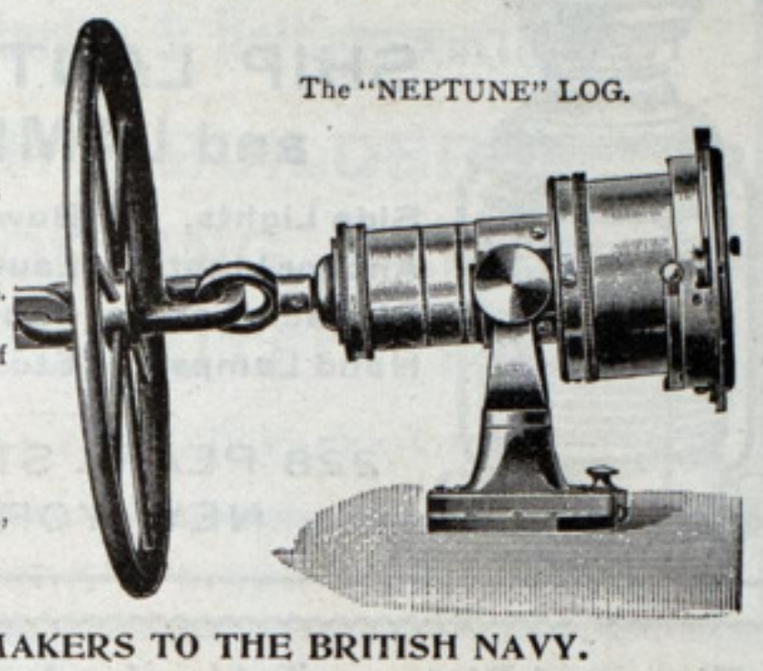

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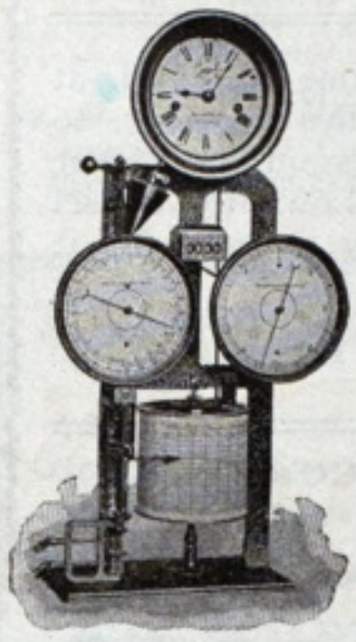

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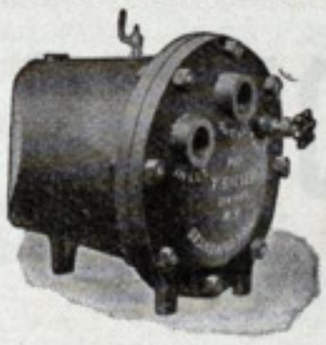

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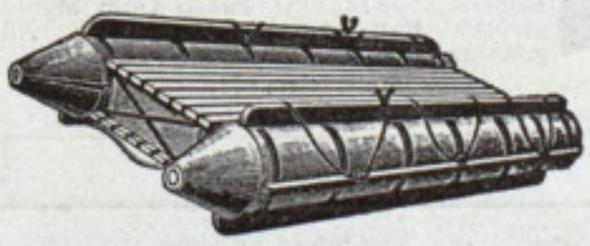

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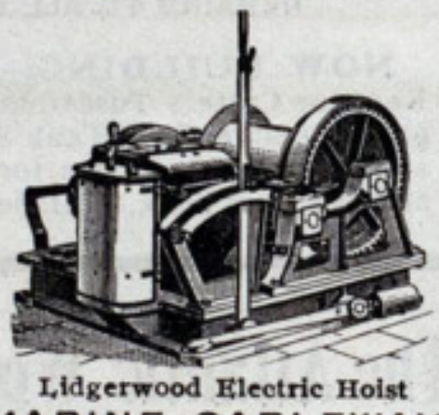

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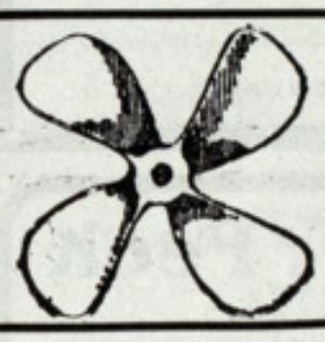

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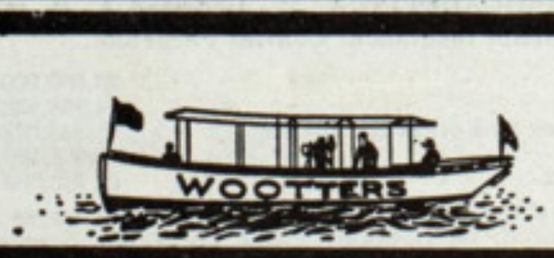

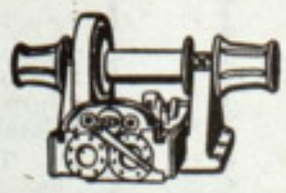

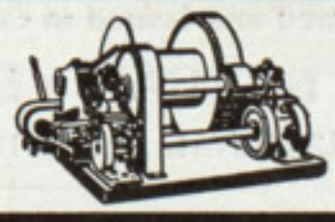

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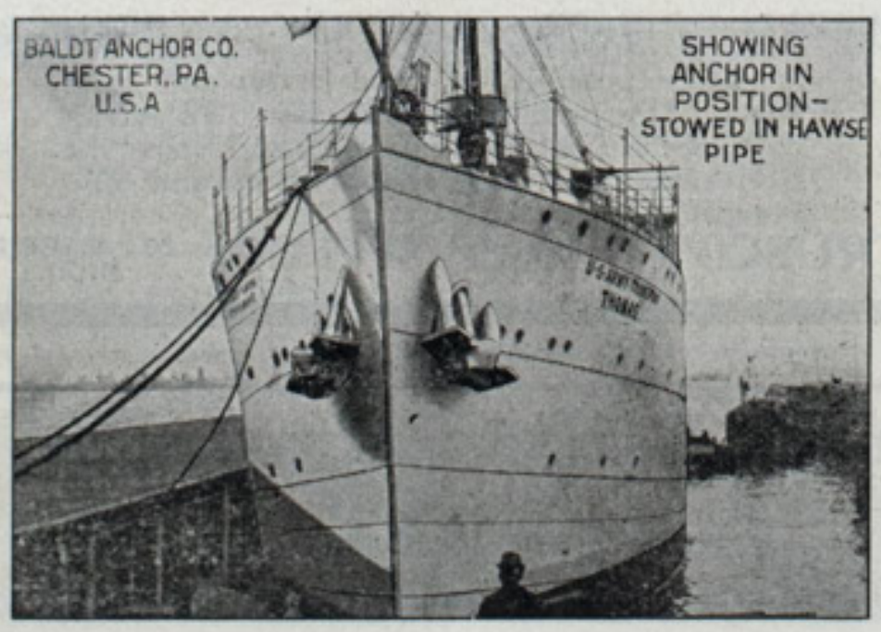

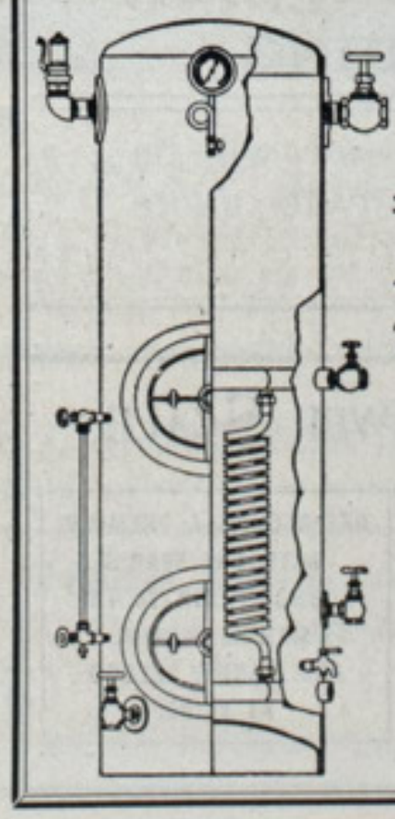

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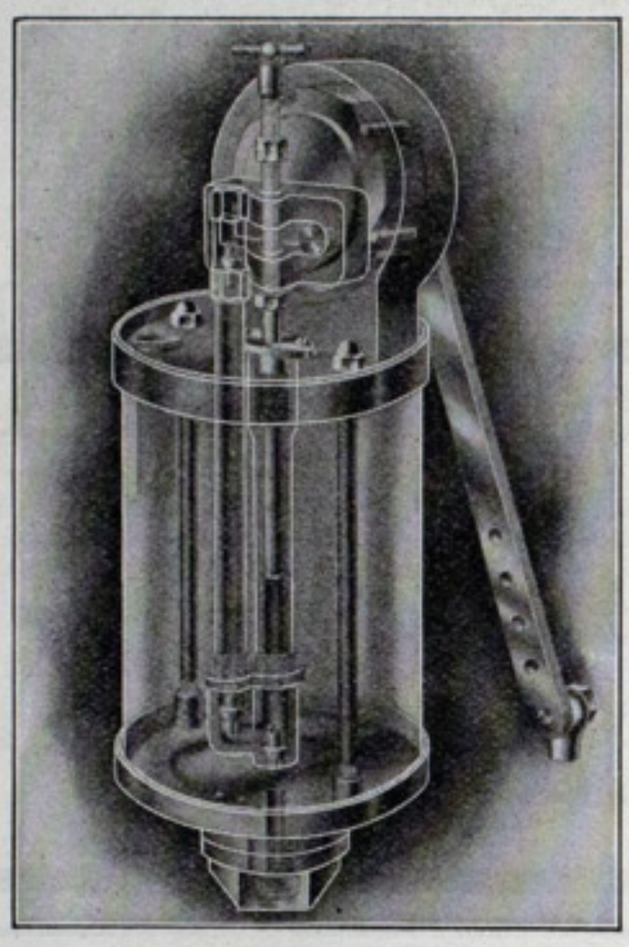

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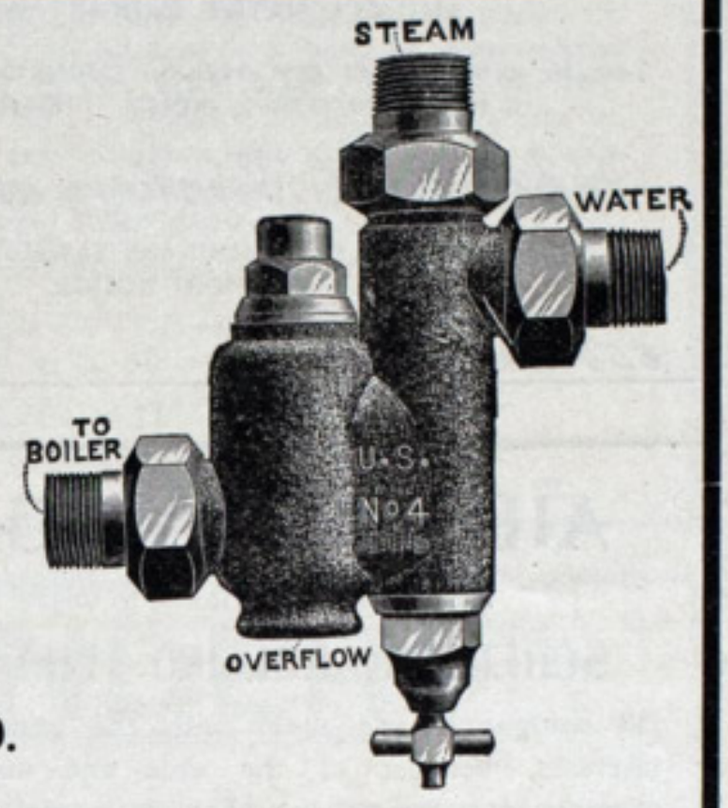

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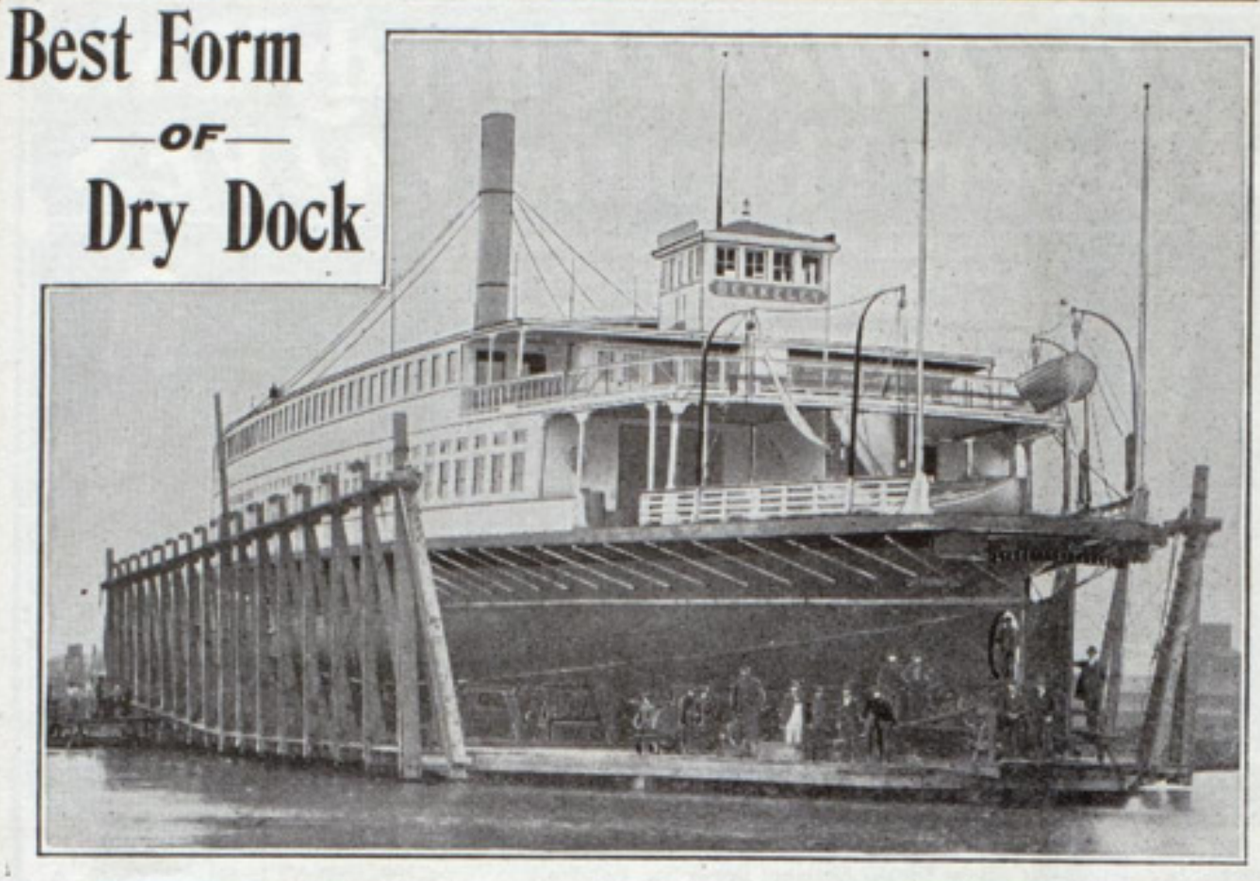

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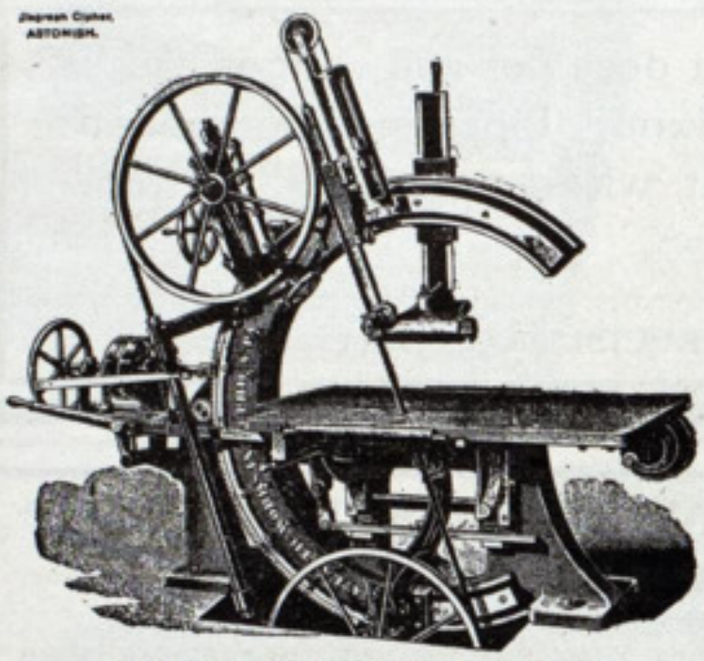

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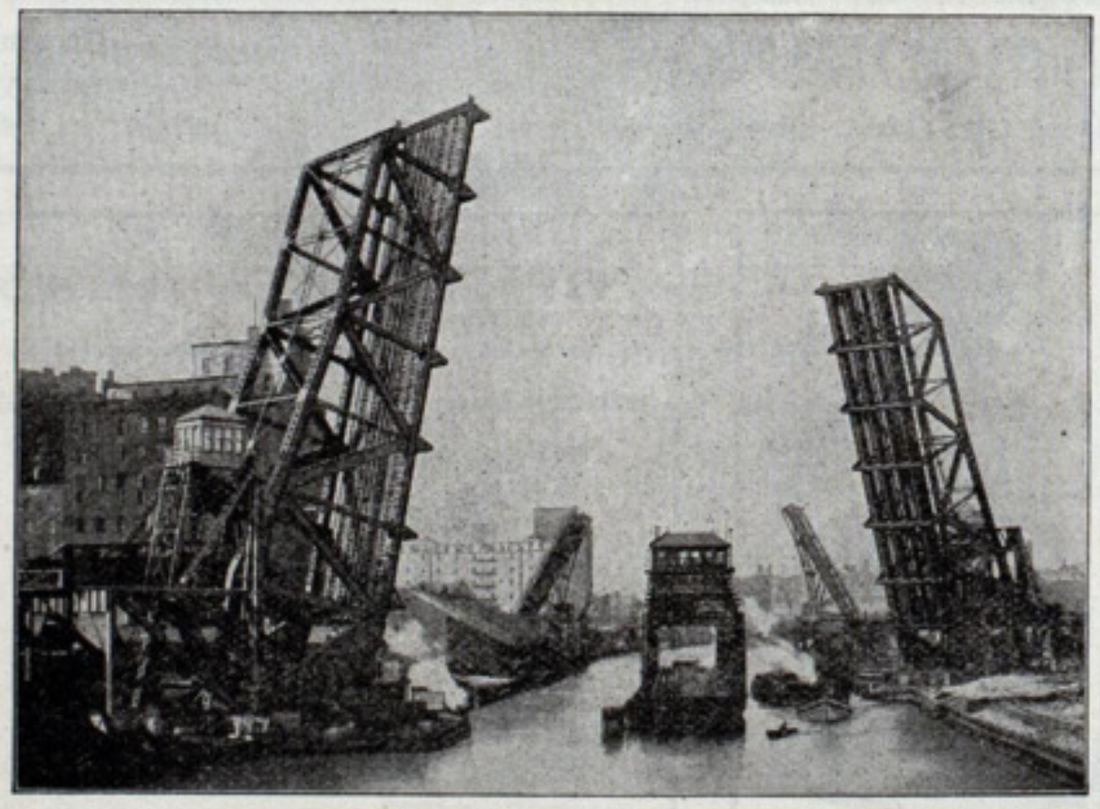

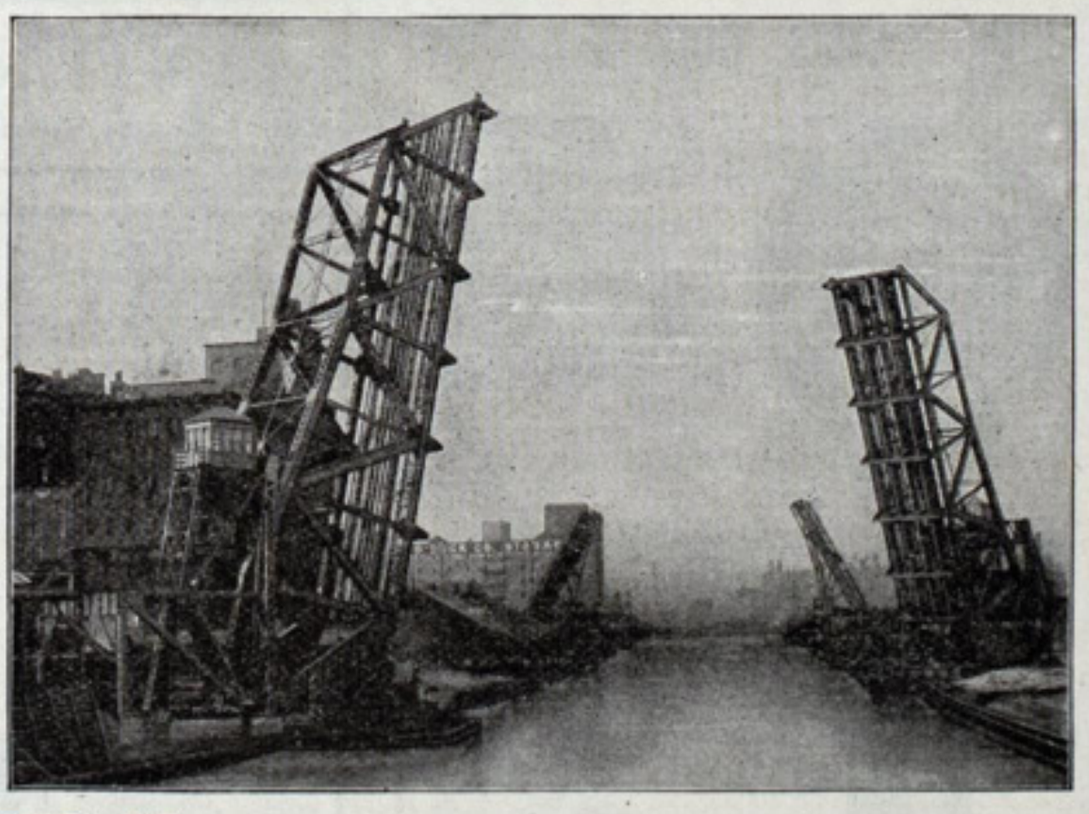

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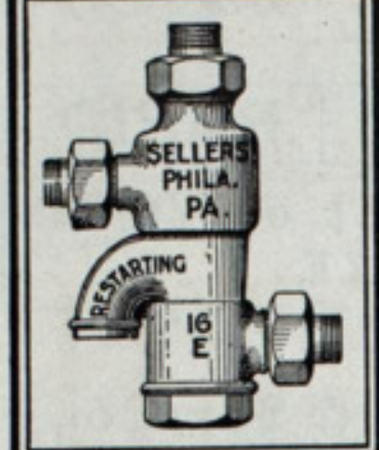

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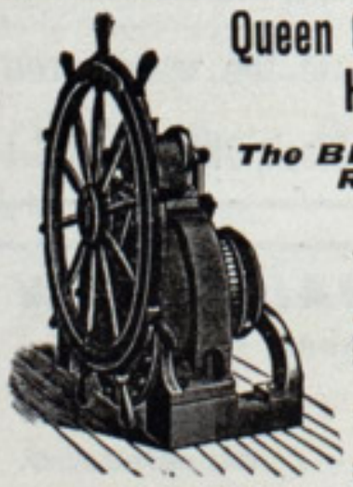

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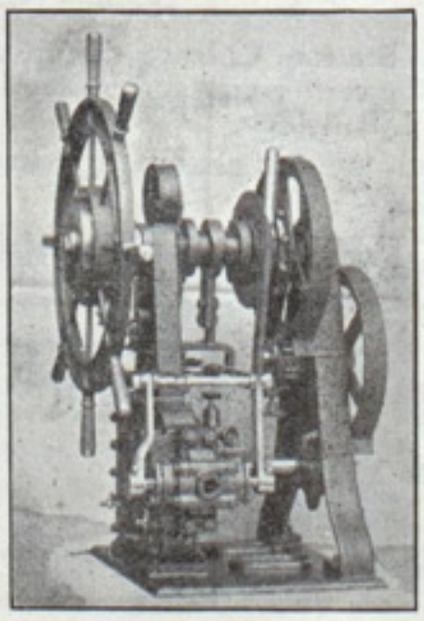

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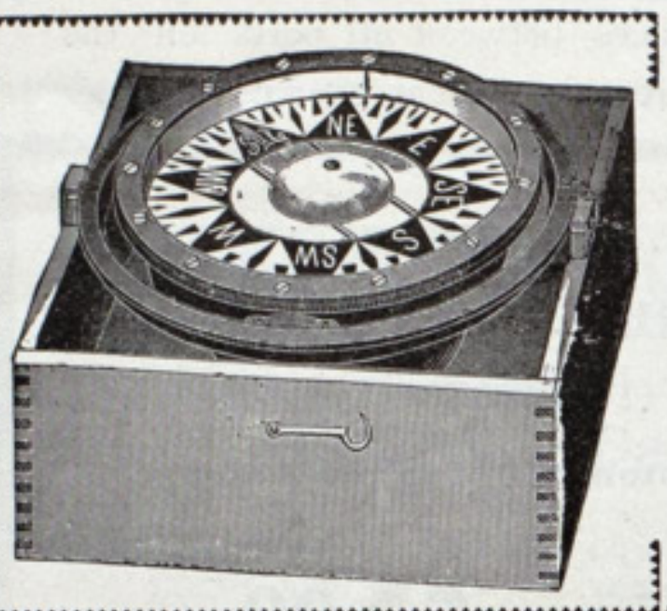

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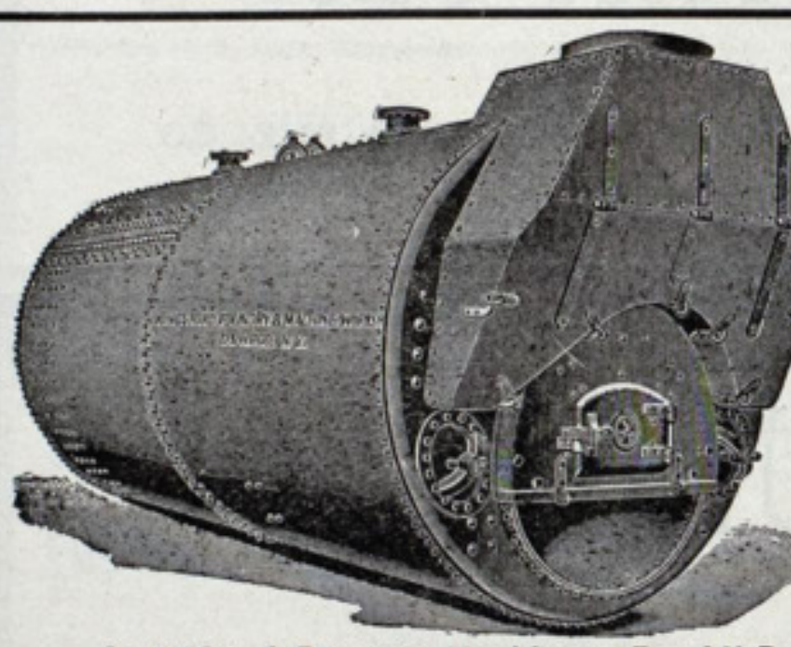

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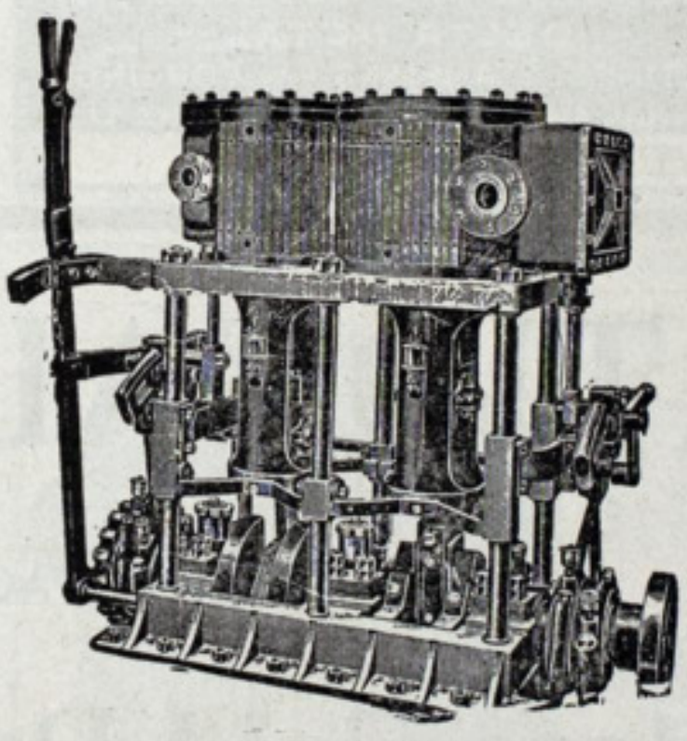

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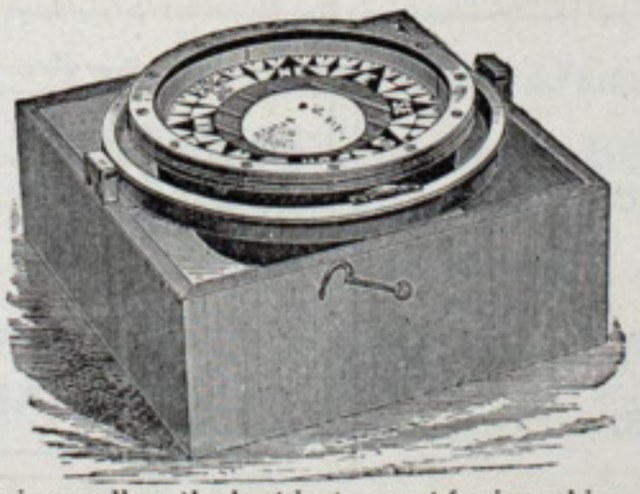

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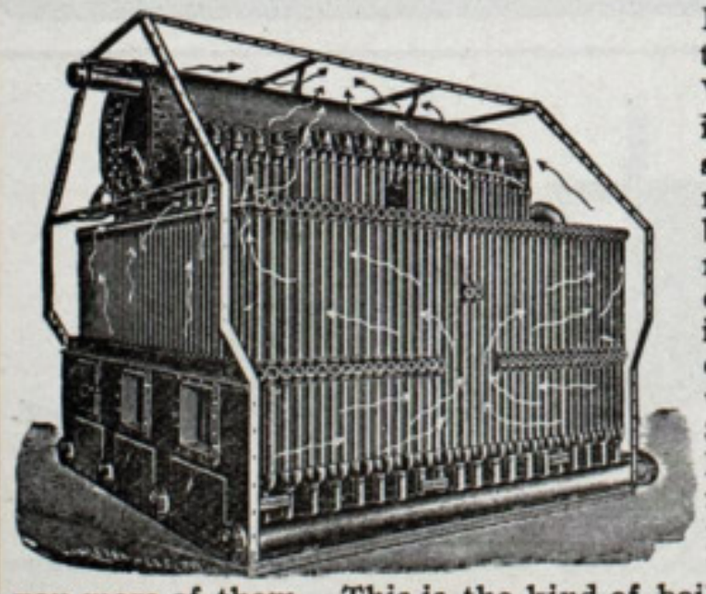

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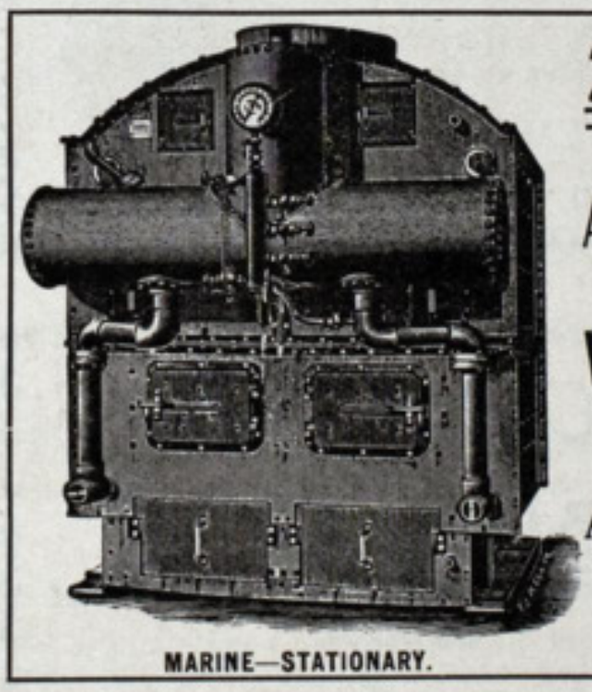

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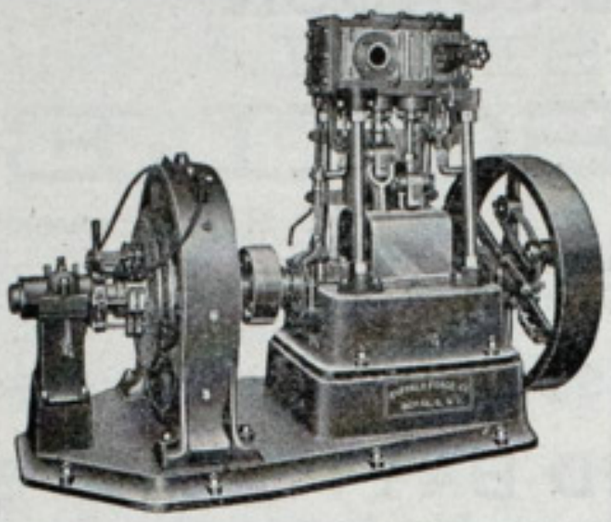

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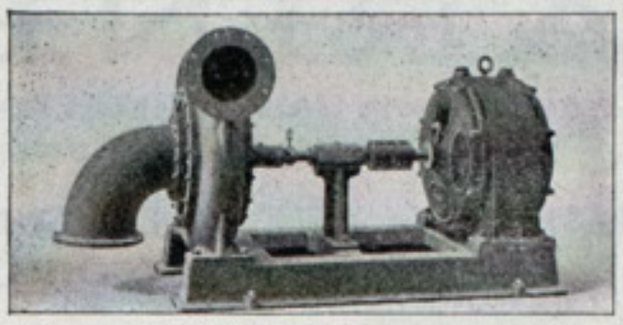

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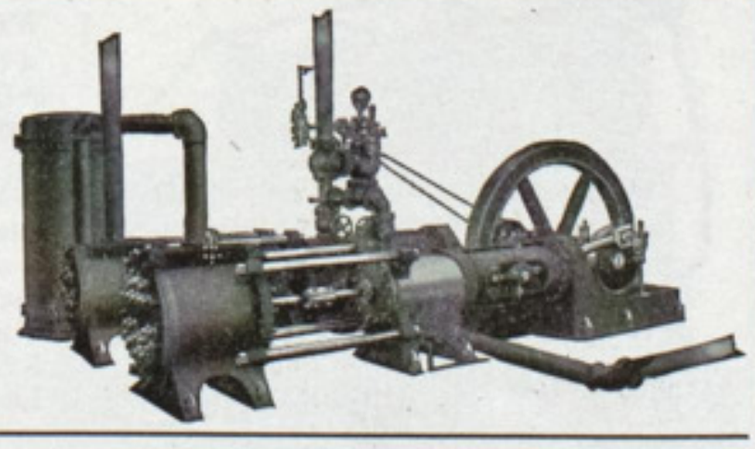

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